OFFICIAL PROCEEDINGS

OF THE

Tenth Annual Convention

Master Boiler Makers' Association

1916

HON. DANIEL A. LUCAS
President-elect

Master Boiler Makers Association

OFFICIAL PROCEEDINGS

of the

Tenth Annual Convention

HELD AT

HOLLENDEN HOTEL

CLEVELAND, O.

May 23rd, 24th, 25th and 26th, 1916

ONE DOLLAR PER COPY

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SUBJECTS AND COMMITTEES FOR 1917 CONVENTION

(Subject to Future Changes).

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1. "PROPER METHOD OF THREADING RADIAL STAYS AND TAPPING OUT HOLES IN BOILER FOR SAME. IS IT NECESSARY TO GIVE RADIAL STAYS THE SAME LEAD AS THE TAP WITH WHICH THE HOLES WERE TAPPED?" —Thomas W. Lowe, Chairman; J. B. Smith and C. L. Hempel.

2. "WHICH IS THE BETTER METHOD OF DRILLING TELL TALE HOLES, BEFORE OR AFTER APPLICATION OF BOLTS? WHICH IS THE BETTER METHOD OF DRILLING FOR EITHER CASE. WHAT IS BEST STYLE OF DRILL FOR OPENING UP TELL TALE HOLE IN OLD STAYBOLTS? DOES IT PAY TO USE HIGH SPEED STEEL FOR THIS PURPOSE? WHAT IS BEST LUBRICANT FOR THE DRILL?" —Bernard Wulle, Chairman; Frank Fischer and W. M. Wilson.

3. "EFFECT OF PROPER UPKEEP OF FRONT END DRAFT APPLIANCES ON FUEL ECONOMY. METHOD USED IN DETERMINING PROPER DESIGN FOR VARIOUS CLASSES OF LOCOMOTIVES."—C. R. Bennett, Chairman; P. F. Gallagher and William George.

4. "BEST METHOD OF BENDING SUPERHEATER UNITS AND KIND OF TOOLS USED FOR GRINDING BALL JOINTS OF SUPERHEATER UNITS AND HEADERS. HOW CAN WEARING AWAY OF SUPERHEATER UNIT RETURN BENDS BE OVERCOME."—M. J. Guiry, Chairman; A. N. Lucas and Andrew Hedberg.

5. "THE MERIT OR DEMERIT OF THE VARIOUS PATENTED METHODS OF APPLYING BOILER TUBES, COMPARED WITH PRESENT METHOD OF APPLICATION."—J. L. Downs, Chairman; C. Browning and Adolph Feisner.

6. "WHAT IS THE BEST TYPE OF WASH OUT PLUG, ARCH TUBE PLUG OR CAP TO BE USED IN ORDER TO OVERCOME LEAKING, WHEN BOILER IS UNDER PRESSURE? KIND OF THREAD, NUMBER OF THREADS PER ONE INCH AND TAPER PER FOOT?"—C. J. Elk, Chairman; John Howe and F. A. Batchman.

7. "WHICH FIREBOX STEEL GIVES THE BEST RESULTS FROM ACTUAL SERVICE TEST, STEEL HAVING A TENSILE STRENGTH OF FROM 48,000 TO 58,000 POUNDS OR 55,000 TO 65,000 POUNDS PER SQUARE INCH?"—Henry J. Raps, Chairman; J. J. Keogh and T. J. Reddy.

8. "WHAT IS THE BEST METHOD FOR SCALING SUPERHEATER FLUES IN THE BOILER? WHAT IS THE BEST METHOD OF RATTLING FLUES? WHAT IS THE BEST METHOD OF HANDLING FLUES IN AND OUT OF THE RATTLER? HOW MANY REVOLUTIONS PER MINUTE SHOULD THE RATTLER MAKE FOR TWO INCH AND FIVE AND THREE-EIGHTHS INCH FLUES? DESCRIBE METHOD FOR SAFE ENDING SUPERHEATER FLUES."—John B. Smith, Chairman; W. H. Evans and George G. Fischer.

9. "WHAT PRESSURE SHOULD BE USED ON HYDRAULIC RIVETERS FOR VARIOUS SIZE RIVETS? FOR WHAT PURPOSE DOES IT PAY TO USE POWER RIVETERS OF THE SMALLER SIZES? WHAT DEGREE OF CONE HEAD RIVET SET GIVES THE BEST RESULTS USD IN CONJUNCTION WITH HYDRAULIC RIVETERS AND LONG STROKE RIVETING HAMMER?"—Andrew Greene, Chairman; Charles E. Frick and L. Fenstermaker.

10. "WHAT IS THE BEST STYLE GRATE FOR BITUMINOUS COAL? WHERE SHOULD THE DUMP GRATE BE LOCATED: (A) IN ROAD ENGINES, (B) IN SWITCH ENGINES? WHAT SHOULD BE THE PERCENTAGE OF OPENING IN GRATES? WHAT SHOULD BE THE PERCENTAGE OF DRAFT OPENING IN ASH PANS, COMPARED WITH AREA OF FIREBOX?"—S. E. Westover, Chairman; John B. Tate and Alex J. Cunningham.

11. "WHAT SHOULD BE THE MINIMUM DISTANCE BETWEEN GRATES AND LOWER BEND OF ARCH TUBES FOR THE DIFFERENT CLASSES OF LOCOMOTIVES. WHAT IS THE PROPER DISTANCE FROM DOOR SHEET TO BRICK-ARCH AND FROM CROWN SHEET TO BRICK ARCH FOR THE VARIOUS CLASSES OF LOCOMOTIVES?"—Charles P. Patrick, Chairman; John Harthill and H. V. Stearns.

12. "WHAT IS THE BEST METHOD OF BRACING LOCOMOTIVE TENDERS? DESCRIBE METHODS USED."—H. J. Wandberg, Chairman; Andrew Hedberg and Frank Gray.

13. "OXY-ACETYLENE WELDING."—L. M. Stewart, Chairman; B. F. Sarver, Mr. Thomas and R. W. Clark.

14. "ELECTRIC WELDING."—P. F. Gallagher, Chairman; Wm. R. Downs, Frank Griffin, P. S. Hursh and C. Ryan.

15. "TO OBTAIN AN EXTENSION OF TIME NOW REQUIRED TO AT LEAST THREE YEARS, REQUIRED FOR THE REMOVAL OF CAPS WITH FLEXIBLE STAYBOLTS."—C. N. Nau, Chairman; T. P. Madden, Bernard Wulle and C. P. Patrick.

16. "WHAT IS THE ADVANTAGE OF CUTTING OFF STAY ENDS WITH OXY-ACETYLENE OVER THE OLD METHOD OF NIPPERS AND CHISEL?"—Thomas Lewis, Chairman; L. Borneman, A. N. Lucas and W. G. Bower.

17. "LAW."—George W. Bennett, Chairman; M. O'Connor and James T. Goodwin.

18. COMMITTEE ON TOPICS FOR 1918 CONVENTION.—John F. Raps, Chairman; D. G. Foley, George Austin and M. J. Guiry.

In Memoriam

F. G. BIRD
Died June 13, 1914

PETER F. FLAVIN
Died January 1, 1916

GEORGE GILMOUR
Died June 15, 1916

PAST PRESIDENTS

(Before Consolidation)

Thomas C. Best .....1902-1904 Deceased
W. M. Wilson 1905-1906
F. J. Graves .....1902 Deceased
J. A. Doarnberger 1903
W. H. Laughridge 1904
J. T. Goodwin 1905
C. L. Hempel 1906

(After Consolidation)

George Wagstaff 1907-1908
P. J. Conrath 1908-1909
A. E. Brown 1909-1910
A. N. Lucas 1910-1911
G. W. Bennett 1911-1912
M. O. O'Connor 1912-1913
T. W. Lowe 1913-1914
J. T. Johnson 1914-1915
Andrew S. Greene 1915-1916

PROCEEDINGS OF TENTH ANNUAL CONVENTION

FIRST SESSION

Cleveland, Tuesday Morning, May 23, 1916.

The Tenth Annual Convention of the Master Boiler Makers' Association was convened at the appointed hour in the Hollenden Hotel, with the President, Mr. Andrew S. Greene of Indianapolis, Ind., in the chair. Members and guests registered were:

Austin, George
Albrecht, J. A.
Allison, Archie
Anderson, Andrew
Alfonte, R. B.
Bock, L. C.
Bennett, C. R.
Bresette, R. B.
Bennett, G. W.
Burnside, C. J.
Bennett, G.
Baumann, C. J.
Bower, William G.
Beck, John F.
Batchman, F. A.
Berry, John
Baird, A. M.
Bader, Cornelius
Berrey, Frank E.
Borneman, L.
Bayer, Fred
Bowen, L. P.
Brooks, J. H.
Bryant, G.
Browning C.
Crimmins, R. P.
Cooper, Alfred
Champion, D. J.
Cannon, W. J.
Conner, F. M.
Crites, John O.
Cunningham, Alex
Cosgrove, P. E.
Conley, Albert H.
Carder, L. J.
Coleman, G. Hayes
Cooper, J. H.
Casey, R. M.
Cross, L. E.
Carroll, S. M.
Cooper, Fred R.
Cantwell, Edward
Conrath, P. J.
Corliss, William J.
Cook, Wm.
Clark, R. W.
Cook, J. E.
Crombie, James
Clark, James C..
Carder, J. F.
Campbell, Jesse C.
Downs, W. R.
Downs, James L.
Denzler, H.
Davey, J. J.
Deen, W. H.
Dittrich, A. C.
Dean, C. C.
Didier, J. L.
Dunford, V. H.
Dugan, Thomas P.
Evans, W. H.
Egan, P. J.
Eberle, Lewis
Fahey, J. L.
Fantom, William F.
Ford, Martin
Feisner, Adolph
Fowler, George L.
Fitzsimmons, E. S.
Frazier, Arthur F.
Foley, D. G.

Fennelly, M. J.
Fritchie, Franklin W.
Gallagher, P. F.
George, William
Garlock, Clifford S.
Goodwin, James T.
Gray, Frank
Gillespie, Wm. J.
Geyer, A. C.
Griffin, Frank A.
German, John
Guiry, M. J.
Greene, Andrew S.
George, W. F.
Gibson, R.
Gilbert, T.
Grosart, John
Harper, Carl A.
Heck, A. R.
Hasse, F. C.
Hursh, P. S.
Holder J. A.
Hayth, W. V.
Hagan, Chas. E.
Hedberg, Andrew
Harthill, John
Holly, C. A.
Hohenstein, E. H.
Hyland, Charles
Hughes, James
Hodges, A. R.
Hogan, Timothy, J.
Hempel, C. L.
Hahn, George E.
Minehan, James H.
Murphy, Martin
Mahar, Thomas
Mitchell, John
McKerihan, T. J.
McDougal, A. G.
McKeown, John
McKeown, William A.
McNamara, J. W.
McHugh, L. P.
McCarthy, Frank
McManamy, Frank
McCuean, R. J.
McAllister, Joseph
McCallister, M. M.
McDermott, John
McGarrigal, John
McGuire, H. W.
Newgirg, M. H.
Nicholson, C. A.
Nicholson, E. J.
Nau, Felix N.
Nau, C. N.

Johnston, Jas. T.
Jacobs, Wm. C.
Knauer, F. N.
Keating, Wm. M.
Kilcoyne, Thomas F.
Kelly, J. W.
Keefe, J. C.
Klein, Charles J.
Kreider, Charles N.
Kieninger, William
Keller, H. G.
Kaiser, G. J.
Lewis, Thomas
Longacre, Charles J.
Libera, Jos. R.
Love, R. L.
Laughridge, William H.
Lockett, J. H.
Lucas, A. N.
Lucas, D. A.
Lacey, Wm.
Larason, W. S.
Luke, M. W.
Meyer, J. L.
Miller, Harry C.
Murphy, W. J.
Madden, J. J.
Madden, John
Moses, L. O.
Miller, J. F.
Mansfield, J. J.
Madden, T. P.
Moore, D. B.
Mallam, T. L.
Nelson, J. J.
Nicholas, E. S.
Ollis, Luke S.
Osborn, J. D.
O'Connor, M.
Orr, John J.
Oliver, Thomas R.
O'Neill, Thos. A.
O'Connor, Geo. A.
Porter, Louis R.
Peters, Philip
Powers, Thos. F.
Patrick, Chas. P.
Phares, John L.
Prout, Geo. T.
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Schmidlin, Joseph B.
Smith, Hugh
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Strinsky, William
Stallings, W. G.
Smith, H. W.
Simms, Edw. G.
Smythe, J. H.
Stewart, L. M.
Seley, C. A.
Squire, Willis C.
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Tredinnick E. H.
Tate, John B.
Thomas, C. A.
Troy, John
Troutman, G. A.
Tate, M. K.
Talbott, T. J.
Tynan, J. B.
Tracey, Bernard C.
Umlauf, E. C.
Usherwood, George B.
Usherwood, T. W.
Weigle, Oliver
Wharton, M. I.
Wulle, Barnard
Wortman, W. C.
White, Geo. W.
Wilson, W. T.
West, Harry V.
Wintersteen, John
Wandberg, H. J.
Wilson, Frank E.
Wagstaff, George
Weldin, Harry F.
Westover, Stephen E.
Welch, Roy
Woodall, George
Wilson, J. T.
Whalen, Chas. P.
Welk, John L.
Wise, August
Young, C. F.
Young, E. W.
Yochem, Frank
Zitterman, Paul J.

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Davis, Harry L., Mayor, Cleveland, O.
Daily, F. J., Shop Demonstrator, Erie R. R. Co., Meadville, Pa.
Foster, O. M., M. M., N. Y. Central R. R., Cleveland, O.
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Johnson, W. S., B. Insp., N. Y. C. R. R., Avis, Pa.
Kuhn, B. F., Asst. M. M., N. Y. Central R. R., Cleveland, O.
Kothe, C. A., M. M., Erie R. R. Co., Marion, O.

Lindreth A., Foreman, N. Y. C. R. R., Cleveland, O.
Longacre, Chas. J., Jr., Trenton, N. J.
McLaughlin, P. H., Elkart, Ind.
McLean, Edward, Gen. Foreman, N. Y. C. R. R., Cleveland, O.
Mallam, John H,, 227 Norway Ave., Trenton, N. J.
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Miller, Harry C., Springfield, O.
Newmarsh, J. C., Shop Supt., N. Y. C. R. R., Cleveland O.
Peck, C. B., Railway Age Gazette, New York City.
Pratt, E. W., Asst. Supt. Motive Power & Machinery, Chicago & N. Western R. R., Chicago, Ill.
Prouty, E., Mech. Expert, Loco. Stoker Co., 10702 Helena Ave., Cleveland, O.
Pack, A. G., Asst. Chief Insp., 401 Southern Bldg., Washington, D. C.
Pfahler, F. P., Gen. Motive Power Insp., B. & O. R. R., Baltimore, Md.
Sasser, H., Shop Demonstrator, Erie R. R. Co., Meadville, Pa.
Schlafge, Wm., Gen. Mech. Supt., Erie R. R. Co., New York City.
Tyler, Oscar, Supv. Safety Appliances, N. Y. C. R. R. Lines West, 1204 E. 105th St., Cleveland, O.
Thurston, Herman B., District Insp., I. C. C., Pittsburgh, Pa.
Talty, John A., Equip. Insp., Public Service Corp., Buffalo, N. Y.
Tulin, T. P., B. Insp., Erie R. R., Meadville, Pa.
Wagstaff, Geo. N., Cleveland, O.
Woodall, Edwin, Sacramento, Cal.
Weik, John, Supt. B. & O. R. R., 1276 W. 87th St., Cleveland, O.
Yergens, W. F., M. M., Erie R. R., Huntington, Ind.

THE PRESIDENT: Ladies and Gentlemen: We certainly appreciate this opportunity of being again allowed to assemble at this, another annual convention, and in recognition of our thankfulness I ask that all present kindly rise while our past-president, John H. Smythe, invokes the Divine blessing upon us and our deliberations.

INVOCATION BY PAST PRESIDENT J. H. SMYTHE.

MR. SMYTHE: Almighty God, our Heavenly Father, we are grateful for this opportunity to lift up our hearts and call Thee Father. We are also glad this morning for the privilege of this assembly of our people. We are glad, dear Father, to meet men with whom we have worked, men whom we have called comrades, men with whom we have later associated as foremen and met in just such assemblies as this, in order to make ourselves more efficient for our positions in life. We thank Thee, dear Father, for teaching us the brotherhood of man; we thank Thee for teaching us that we can make ourselves better if we so wish, we thank Thee, dear Lord, for this city in all its beauty, for its people and its hospitality and generosity; for good health, and above everything else, we are glad that Thou hast seen us here safely and permitted us to be here to make our-

selves better fitted for our various positions in life. We pray Thee, kind Father, to bless all our deliberations, bless our President, bless our officers; they have given much thought to making this occasion a success. Dear Lord, let Thy richest blessings rest upon the Supply Men's Association, bless their President and executive officers and staff, and we would not, while we are calling upon Thee, neglect to ask Thee to bless the executive officer and his staff of this beautiful city. We ask Thy blessing for the disappointed ones who could not get here, no doubt we have their thoughts. Now, in conclusion, dear Lord, bless each one of us, forgive us all our mistakes in life, bless all our deliberations, and when our mission on earth is done, we pray that we may be gathered around Thy throne without the loss of one of our number. We ask this in the name of Jesus Christ, our Saviour. Amen.

THE PRESIDENT: The city of Cleveland has certainly paid us an honor this morning in recognizing our convention with the presence of his Honor, the Mayor, Mr. Charles L. Davis, who will now address the convention. (Applause.)

ADDRESS OF WELCOME BY MAYOR HARRY L. DAVIS

Mr. Chairman and Gentlemen:

I want to congratulate you upon the most successful opening of your convention. I have attended many openings in the city in the past few months, but have never attended one where there have been so many in attendance the first morning. You are to be congratulated. In introducing me, your President called me "Charles" L. Davis; the name is Harry L. Davis; I want that known. Of course most of you don't vote in Cleveland, but then there may be some who do and you may have friends here, so I want to have the name right. (Laughter.)

I have carried with me for a long time a little story which I think has something on the boiler makers. I was attending a convention in White Sulphur Springs, Va., about two years ago.

Before I became Mayor of Cleveland, I was in the insurance business, and this was a meeting of insurance men. I was sitting in the lobby before the session convened and I heard two of the ladies from New York who were visiting the hotel say, "Who are these persons who are wearing badges and seem to be attending a convention in this hotel?" The other lady replied, "Why, they are insurance men." Her companion said, as she looked through a pair of those glasses with a stick on them, "My gracious, the next thing we know we will have the boiler makers down here." (Laughter.) So I thought if I ever had the chance to speak to any boiler makers I would tell them, "you see we are in the same class, the insurance men and the boiler makers." (Laughter.)

The people of Cleveland are delighted to have you with them and feel complimented that out of the great number of beautiful cities in the United States that you have selected Cleveland. We wish you every success in your convention; we hope you will present an opportunity to us at every moment, whereby we can make your stay

pleasant. We want you to feel that Cleveland is a hospitable city as well as a pretty one; we want you to know that the city's administration, speaking for the people, will do everything possible. We want you to call on us and I hope to have the opportunity tonight at the banquet to talk to you again. I have another engagement which I am endeavoring to break because I want to be with you. I wish you every success, not only now but all through life. (Aplause.)

THE PRESIDENT: I will now call on Past President P. J. Conrath to respond to the address of the Mayor.

RESPONSE OF PAST PRESIDENT P. J. CONRATH

Mr. President, Mr. Mayor, Fellow Members of the Master Boiler Makers' Association, Ladies and Gentlemen:

It becomes my great pleasure this morning to respond to the Honorable Mayor of this great city, and I am sure I voice the sentiments of every one when I say that your hearty welcome is one that has impressed us all. You have given us in expectation, a view of Cleveland even greater than we have ever had before. In behalf of the ladies, and members of this Association, it is my privilege to express our sincere appreciation. We are pleased to be with you this morning and accept of your hospitality. The hospitality and kindness of your people is not entirely foreign to us. Many of those present this morning still have fond memories of the successful convention held in this city in 1907, and of the enjoyable time spent by us with the people of Cleveland during that convention.

The city of Cleveland with its 700,000 inhabitants, ranging fifth in population of the great cities of the United States, is renowned for its splendid government, its enterprise and good citizenship, its large manufacturing industries and great transportation facilities, and last, but not least, for its brotherly love. Its transportation facilities, offer an inducement for manufacturers to locate in the city of Cleveland and its immediate vicinity. Probably 90 per cent. of the traffic of the Detroit River is also handled by this city and it tends to increase your population. Cleveland is bound to grow in the future as it has grow in the past, and is destined to become a much greater city. This city has something in common with boiler makers—a mutual interest—which tends to draw us closer together and further promote close and enduring friendship, for a large percentage of the boiler plate, as well as many of the rivets used in assembling the boiler are manufactured here. This city has also played an important part in the life of this Association. It was here nine years ago that two organizations were consolidated into the present grand organization which has since flourished and contributed to the benefit and success of the boiler trade. In organizing and banding together men have in view a purpose which by united action alone can be accomplished. So it is the aim of this Association to strive to work out the problems in our particular line, thereby contributing benefit not only to our own members but to many others. In these modern times of progress it is necessary for men to assemble in conventions for the exchange of ideas and discussion of subjects for the betterment of the trade and improvement of shop practice; also, as far as possible, to over-

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come difficulties and eliminate trouble which arises from time to time, especially in the boiler trade.

We have again returned to further deliberate upon different subjects, to solve some of the problems with which we have to deal, and to renew friendships formed. We feel that we will all be benefitted both socially and educationally—the people of Cleveland and the men who have gathered here from all parts of the United States, from Canada, and I daresay, some from Mexico. Each man will present the different water conditions throughout the country and the important factor of different styles of design and construction of boilers. So it is plainly evident that the continuous study of these many questions undoubtedly will help to eliminate trouble, and at this convention the scope of our services of information will be greater and our knowledge will be proportionately increased. We feel, Mr. Mayor, that your hearty welcome will help us to accomplish the purposes for which we have gathered here. Please accept assurances that we will conduct ourselves in such a manner as to make us worthy of your confidence. The ladies, God bless them, who have again gathered in large numbers this morning, lend a charm and cheer to every occasion. They have listened to your cordial welcome and feel that they are among friends and will be well taken care of. When we take our departure we will carry with us fond recollections of our sojourn and will look forward with pleasure to another convention in Cleveland. In conclusion, in the words of Longfellow,

"Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labor and to wait."

I thank you. (Applause.)

THE PRESIDENT: I am sorry to announce that our friend Mr. D. R. MacBain of Cleveland, superintendent of motive power of the New York Central, is unable to be with us, but he has sent his address which which will now be read by the Secretary.

ADDRESS OF MR. DANIEL R. McBAIN

To the President and Members of the Master Boiler Makers' Association. Gentlemen:

I have noticed that in the program of your convention which is to open Tuesday morning, May 23d, at the Hollenden Hotel, you have slated me as one of the persons who is to address the convention. This has somewhat startled me as I had no intention that I was to make anything in the nature of a formal address, my idea being that, if it were possible for me to be present, I would give a few minutes talk along the lines of our various duties in the maintenance of the motive power of this country, in which you gentlemen have played a major part from the beginning of time.

I have noted with a great deal of pleasure the various subjects that have been written up and slated for discussion at your convention, and I must say that, like their predecessors, I find the hard, common sense, practical effort that has accomplished so much in the way of bettering the railroad service on the lines of this continent.

Your subject on "Oxy-Acetylene and Its Advantage in Boiler Repair" is one which, in my opinion, should be given the closest atten-

tion on the part of all concerned in the work that we are carrying on, and, notwithstanding the incoming of the electric welding devices and the uses to which such devices can be applied with profit, I believe it would be a mistake at this time to allow the oxy-acetylene process to drop out of our minds in the slightest degree, as I believe that it has its field distinctly in a certain line of work and that it will always prove more advantageous for that particular line of work than any of the electric welding processes so far developed. I do not make this statement with any thought of disparaging the electric apparatus in any way. On the other hand, it has its advantages and has a field distinctly its own that in my opinion cannot well be covered by the oxy-acetylene process, so that both devices should have our best thought and attention at all times with a view that they may be developed to their highest point of advantage to us in our maintenance schemes.

The subject "Do Long Flues which are of such Length and Thickness that they sag on being Applied to Boiler, Vibrate with the momentum of the Locomotive when in Service" is one that is of considerable interest to me, because I have made certain investigations and experiments in that line, which, to my own satisfaction at least, have demonstrated that there is a certain movement of the flues, caused by excessive heat or cold, which increased or decreased the sag in the longest flues a considerable extent under the varying conditions of service from the time that the fire is first applied to the locomotive until the time it is hauling its train on the road, the indications being that under certain conditions of service the sag in the tubes is actually straightened out, and under others the sag is increased.

With this fact fairly well established we may be able to couple up the information so obtained with some of the results we find in flue maintenance in regular locomotive service, that is to say, you gentlemen are all well familiar with the fact that when an engine with the flues set in the old manner came in leaking badly you usually found it possible to run a piece of good thick paper between the bead and the flue sheet at the back end; this especially after the engine had cooled off but had not gotten cold, and inasmuch as the boilermaker usually went into the firebox to make repairs on such flues, as soon as the heat therein was reduced to a point where going in was possible, such repairs usually resulted in clinching the flues where they were, that is, when they were sticking anywheres from 1-64 to 1-32 inch further into the firebox than they should be. Clinching the flue in that position, beading it up and turning the engine out had the tendency, after that operation had been performed a few times, covering a few months, to shorten the normal distance between the flue sheets, usually resulting in the back flue sheet being pulled in towards the shell of the boiler in the greatest zone of leakage.

The questions which we should try to answer are (1) Why do the flues protrude into the firebox as outlined in the above?; (2) What can be done to avoid the flues pushing back through the back flue sheet in this manner?

The subject "Why Do Front Flue Sheets Bulge and How Can it be Eliminated" may be explained by a study of the conditions above referred to.

The report of your committee to obtain extension of time limit for removal of caps with flexible staybolts is one that your association may justly feel proud of, as they have brought out very clearly

and concisely, in my opinion, the fact that removing these caps for inspection, as now provided under the Interstate Commerce Commission rules, is entirely unnecessary, does not add anything to the safety of the boiler, and imposes an unusual and unnecessary expense on the railroads, and I trust that our good friend, Mr. Frank McManamy, and his co-workers will find it consistent to make such concessions as will be of mutual benefit to the carriers and the Commission as well in this respect.

I am going to turn over to your Secretary a copy of some remarks recently made before the Western Railway Club in Chicago, which for the most part will be familiar to you gentlemen who were present at the convention at Niagara Falls in 1910. There is this to be said, however, that in addition to the information on hand and published at that time, the six years of experience that we have had since in the maintenance of some of the largest and most important power on this continent has strengthened our ideas along that line of thought to a point where we are now convinced that the theories advanced and partially confirmed by the experiments made are more than borne out by long experience in practice, and it is my opinion that persistent and continued investigation and experimentation along this line will result in great good to the maintenance of locomotives of the future.

When we arrive at that stage of perfection wherein all unnatural stresses in the firebox in its relation to the outer shell and the barrel of the boiler are relieved—and I believe this to be entirely possible, we will have removed 99 per cent. of the troubles incidental to locomotive boiler maintenance. Is not this thought worthy of your fullest and most earnest consideration?

It is my personal opinion that someone, some of these days, will design a front and back flue sheet with such flexibility as will absolutely relieve strains at the flue anchorages at both ends. Just how this will be gone about it is hard to say, but it seems to me that the proper plan to work upon is in putting in a front flue sheet that will move with the lengthening and shortening of the flues, without much resistance, a sufficient amount to relieve the strains both in compression and tension which we know flues are now subjected to in the ordinary service.

I have taken a good deal of your time, and inasmuch as I notice that you are to be addressed by Mr. Frank McManamy, who I know will have something very interesting to say to you and will require some time to say it, also that "Jack" Carroll is to address you—and "Jack" usually uses up some time—I feel that I have said about enough. Welcoming you to our city on behalf of the railroads centering herein, and trusting that you and your families will have a most profitable and enjoyable time, I am

Very sincerely yours,

D. R. MacBAIN.

(Vice-President D. A. Lucas in the Chair.)

VICE-PRESIDENT LUCAS: We will now listen to the annual address of our worthy President, Mr. Andrew S. Greene:

ADDRESS OF PRESIDENT ANDREW S. GREENE.

Ladies and Gentlemen and Members of the Master Boiler Makers' Association:

Another year has passed and we are here today to call together the Tenth annual session of this association. Doubtless since our last meeting in that great city of Chicago, many of you here have experienced great blessings and many of you have experienced sorrow and sadness. Let us rejoice with the favored ones, and weep in silence for those who mourn. Gratitude compels us to be thankful for the many blessings that we have enjoyed during the past year.

Our association has come together for the purpose of taking into consideration the many subjects that are to come before this body for discussion with a view, if possible, of enlightening us all None come here but to be enlightened, and edified by the information available. I am pleased to meet you all. This association welcomes you with a heartfelt gratitude at this, their annual session. We are especially thankful to the ladies who grace this occasion with their bright and smiling countenances.

To my mind the pursuit of the boiler maker is one of the most difficult and trying of any of the pursuits of life. It is filled with disappointments, it is filled with deviltries, and climatic influences have their effect upon results. Even our superiors sometimes in a measure are overbearing to us in their expectations. The critic does not stop very long to think or consider before passing judgment upon boiler work. Our occupation, more than all others in the railroad business, is fraught with disappointment and more susceptible to harmful influences that we cannot control. Hence it was that the pioneers in days gone by planned and conceived this association for the purpose of endeavoring by mutual intercourse to overcome those powers which are apt to do us harm in our business. They indeed built wiser than they knew. Imagine some years ago the temerity of a few of these men getting together and planning an association that was to go on from year to year; and be it said to their credit, unless I am incorrectly informed, they never missed a meeting. Annually, as the years passed on, have these men come together, and discussed and talked over matters pertaining directly to their business, and also the business of their employer. It is unnecessary for me to recount, as has been done on former occasions of this kind, the amount of good that has innured to the railroad company, our employers, by this meeting together, by this social intercourse and by this interchange of reason and judgment. Time has been shortened in our work, obstacles have been overcome, material even has been analyzed and the bad has been quietly put aside, and while rank weeds are still found in the garden, as time passes on they will disappear under right cultivation. The railroads will soon learn that the boiler maker is getting educated, that he is getting right up to what is required of him, to do permanent work that will stand and be a credit to the man who performs it.

Now let me beg of you all to be prompt in your attendance on the sessions of this body. We have men here whose voices will enthuse you all before this meeting closes. We have the great Fog Horn from Kentucky, the tall Sycamore from Virginia, the flying Dutchman from Roanoake, the brilliant orator from Canada, and the noted O'Connor from Iowa. Thanking the ladies for their

ANDREW S. GREENE
Retiring President

CHARLES P. PATRICK
Second Vice-President.

THOMAS LEWIS
Third Vice-President.

JOHN B. TATE
First Vice-President.

T. P. MADDEN
Fourth Vice-President

E. W. YOUNG
Fifth Vice-President

kind attendance and also the supply men for the good they have done in our behalf, I bespeak for the valuable committee reports prepared your most thoughtful consideration.

(President Greene in the Chair.)

THE PRESIDENT: We will now listen to the report of our Secretary, Mr. Harry D. Vought.

ANNUAL REPORT OF THE SECRETARY

To the Officers and Members of the Master Boiler Makers' Association:

GENTLEMEN: The undersigned begs leave to report that the total collections remitted to the Treasurer for the fiscal year ended March 31, 1916, were $1,125 from the following sources:

From dues	$863.00	
From initiation fees	207.00	
From miscellaneous sources	55.00	$1,125.00

MEMBERSHIP RECORD

Total number of members reported in 1915	370	
Total number of members admitted at Chicago, 1915	63	
Total number of members reinstated	45	
		478
Total number of members dropped for want of correct address	21	
Total number of members deceased	1	
Total number of members suspended for non-payment of 1915 dues	30	52
Total number of members March 31, 1915		426
Total number of members in arrears for dues for 1915-1916		80
Applications received since last convention and approved by the Chairman of the Executive Board subject to ratification by this convention (1916)		21

In closing his report the Secretary tenders his acknowledgments to the officers of the Association and the members of the Executive Board for courtesy and consideration extended during the past year, and also to officers and members for many complimentary letters received during the year that commended the work of the office and the manner in which it was handled. This was a new experience to some extent and has not only commanded appreciation but has also been a measure of encouragement and an incentive to further effort to satisfy all concerned.

Respectfully submitted,

HARRY D. VOUGHT,

Secretary.

THE SECRETARY: For the information of the members, the Secretary should supplement this formal statement covering the fiscal year, with the gratifying fact that additions to the 21 applications referred

HARRY D. VOUGHT
Secretary

to have been received since yesterday. If the progress already made continues, we will have the satisfaction on our opening day of having probably 40 applications. This is believed to be without precedent and reaches close to the record for an entire convention.

Every picture has its shadows as well as its bright lights; without the shadows the beautiful features of the picture which engage and enthrall our minds, would disappear. It is therefore gratifying to further state, for your encouragement, that while quite a list of delinquents has been reported the number has already been reduced at this convention. If this continues the list will be still smaller. In some cases those who paid up were not members in arrears for the past year but for three years. These men learned that they are missing something, not only in the literature of the organization but in depriving themselves of the practical benefits of being present and hearing the discussions, participating in the meetings and enjoying the good fellowship that marks every session of every convention and always has since this association was formed. (Applause.)

MR. LAUGHRIDGE: I move that the report be received and referred to the Auditing Committee. Carried.

THE PRESIDENT: I would now like to call on Mr. W. C. Connelly of the Connelly Boiler Manufacturing Company, to make a few remarks.

ADDRESS OF MR. W. C. CONNELLY

Mr. President, Ladies and Fellow Boiler Makers:

It is a great honor to be here this morning and to see such a fine assemblage. It certainly would put our organization to shame to see so many. While we are greatly pleased to have 100, I believe you have about 400 on the very first day. I notice that you have a splendid program and am sorry that I will not be able to attend all the sessions, but it is my intention to be here as often as I can.

The topics that your Association has before it are quite in line with some of the things that the American Boiler Manufacturers are doing. At the present time our greatest efforts are for the establishment of a uniform boiler code throughout the United States, pertaining to the construction of steam boilers. O course that does not take in the locomotive type of boiler in which you are chiefly interested, because that is governed by Interstate Commerce laws. I see on your program many topics that our Association is discussing and studying and I feel if I could be present at all of your sessions I would hear and receive a great deal of information. Our convention will meet on the 20th of June and we are all dealing with the same elements, steam, under high pressure, superheat and bad water conditions. The latter interest us greatly, and constitute one of the greatest problems with which we all have to deal. Your engines take water in Cleveland which is good, but when some other point or city is reached where the water is very bad and the engine and boiler come into the shop, it develops upon you gentlemen to put the boiler in right condition. We are all getting somewhere with these meetings and it is

very commendable that men occupying such positions as you master boiler makers do will devote so much of your time to the study of these problems. The benefit is not directly to yourselves but to the traveling public. Things are changing. Locomotives today have a very much lighter pressure than those of a few years ago. Practically all of the railroad locomotive boilers that are being built have superheater type of boilers; that is a new feature. Even in stationary service we find a great many stationary boilers are being built for 300 pounds steam pressure and having superheaters for 350 degrees superheat. I believe that is one of the highest combinations of any installation in the country. Furthermore, at the present time boilers are being manufactured in 2,500 horsepower units which will be the largest in the world. We are all progressing, the builder of stationary boilers is doing all he can and we are doing big things as boiler manufacturers. As a resident of the city of Cleveland I heartily welcome you and I hope your stay here will be beneficial. (Applause.)

THE PRESIDENT: If any of the ladies wish to leave they are at liberty to do so now.

MR. GOODWIN: The ladies do not have to leave. If they would like to remain we would like to have them.

THE PRESIDENT: We will now listen to the report of the Treasurer, Mr. Frank Gray.

MR. GRAY: I have made this report in detail so that members will know just exactly what we are spending money for. One object is because we spent a little more than our income and I thought it was the Treasurer's duty to keep all of the members informed, as well as the committees, as to what we are doing in the financial line. Of course we have a good balance in the Treasury as yet, but you cannot go on at this rate. I am merely making this explanation so that every one will know what we are doing.

ANNUAL REPORT OF THE TREASURER

To the Officers and Members of the Master Boiler Makers' Association:

Herewith is respectfully submitted a report of the receipts and expenditures of the Association from April 7th, 1915, to March 31st, 1916:

Balance on hand April 7th, 1915	$ 886.97
Cash received from Secretary Vought	1,130.00
Total receipts	$2,016.97

DISBURSEMENTS.

To E. C. Bruen, printing stationery, envelopes, etc.	$ 158.92
To Union Card & Paper Co., heavy mailing envelopes	18.00
To New York Commercial, printing advance papers for 1915 convention	129.32

FRANK GRAY
Treasurer

To New York Commercial, printing 50 copies President Johnson's address	3.25
To New York Commercial, printing, postage, expressage, and mailing 711 copies 1915 proceedings	119.49
To New York Commercial, binding 750 copies of 1915 convention proceedings	127.50
To New York Commercial, 700 postals and press work	9.50
To H. D. Vought, Secretary, percentage on dues collected	299.25
To H. D. Vought, expenses incident to bringing his secretary to Chicago convention	81.80
To H. D. Vought, expenses attending Chicago convention	93.39
To H. D. Vought, clerk hire at Chicago convention	4.00
To H. D. Vought, miscellaneous office expenses, telegrams etc.	58.18
To H. D. Vought, for furnishing 171 copies of 1915 convention proceedings to S. M. P.'s and heads of contract shops	128.45
To H. D. Vought, three copies 1915 Proceedings to I. C. C. Boiler Inspection Department	2.25
To President J. T. Johnson, stenographer's services	30.00
To G. K. Anderson, reporting Chicago convention	100.00
To John Winterstein, expenses incident to the Executive Board	6.67
To C. D. Ruse, one 10-k. Gold Badge	17.50
To Fidelity Deposit Co., two premiums on Secretary Vought's Bond	10.00
To Wm. Gray, 500 31 Multigraph letters	2.05
To Addressograph Co., addresses and plates	5.55
To Chicago Optigraph Co., rent for stereopticon machine	5.00
To General Drafting Company, line cuts, half-tones, electrotypes, etc.	35.00
To F. Gray, Treasurer, three bank drafts	.15
To C. N. Nau, expenses incident to Executive Board	17.87
Total expenditures	$1,463.00
Balance on hand	553.88
Grand total	$2,016.97

Respectfully submitted,

F. GRAY, Treasurer,

MR. LAUGHRIDGE: I move the report be received and referred to the Auditing Committee. Carried.

THE PRESIDENT: Next on the program is Miscellaneous Business.

THE SECRETARY: The President has appointed the following committees to serve during the convention:

Audit: J. H. Smythe, C. N. Nau, G. W. Bennett. Resolutions: A. T. Hodges, C. P. Patrick, John Harthill. President's address: A. N. Lucas, J. J. Davey, M. J. Guiry.

THE SECRETARY: We have quite an accumulation of other business which, with your permission, I will now place before the convention.

Mr. John Harthill acknowledges the floral remembrance sent him when he had the misfortune of being compelled to undergo an operation and was confined to a hospital.

Mr. Harthill invites the members of the Association to visit his Collingwood Shops of the New York Central.

Invitations for the next convention have been received from Minneapolis, New Orleans, Buffalo, New Haven, St. Louis, Louisville, San Francisco, Asbury Park, Charlotte, S. C., New York, Cincinnati. These will go to the Executive Board under the rules of the Constitution and By-Laws.

The National Trades Association asks this Association to go on record as opposed to House Bill 9671, known as the Stevens Supply Men's Bill, now before Congress. The President directs me to announce that this is received and filed, in accordance with the established policy of this Association.

William Krum, of Eagle Grove, Iowa, writes that on account of ill health he has been obliged to retire from active service with the Chicago & Northwestern. He has been placed on the pension list and regrets very much that he is unable to be present at the convention.

The Link-Belt Company of Chicago, in common with a number of other contract shops—the heads of shops as well as superintendents of motive power of railroads—were given last year complimentary bound copies of the Proceedings of the convention in Chicago. The Secretary begs to say that this, in a measure, was responsible for the unusual expenses shown in the report of the Treasurer. Of all who received that large number of copies, the Chicago concern mentioned was the only one that returned its copy, but with a very pleasant letter in which they say:

Chicago, Ill., August 31, 1915.

Harry D. Vought, Secretary,
Master Boiler Makers' Association,
New York City.

Dear Sir: In reply to your letter of the 27th: We returned your book because we have no particular use for it at this office. Your book was gotten up in such nice shape that we believed you would fine someone else who could employ it to better purpose and probably be very glad to get it.

Yours very truly,
LINK-BELT COMPANY.

WM. S. HOLL.

As the Secretary has already explained the situation with regard to new applications, it will not be necessary to repeat it under this heading.

The Underwood Typewriter Company, with its usual courtesy, has supplied the Secretary's Headquarters with one of its best machines for carrying on the work of this meeting. We have with us an efficient typist and stenographer, and if the working committees have any reports to prepare they are asked not to wait until Thursday night or Friday morning to have this work done. They are perfectly welcome to make use of these facilities and probably will be saved time and trouble.

On motion the convention adjourned until Wednesday morning.

SECOND DAY

The convention reconvened at 9 A. M.

THE PRESIDENT: The convention will please come to order. The Secretary has some matters to present.

THE SECRETARY: For the benefit of the official stenographer of the convention, you are urged, whenever you rise to speak, to give your name and the name of the railroad you represent. Please be particular about this so that you will have your name and your remarks correctly recorded for the official proceedings.

Past President T. W. Lowe has wired the President as follows:

Winnipeg, Man., May 22, 1916.

Andrew S. Greene, President M. B. M. Association, Cleveland, O.:

Greetings to all from wife and self. We regret absence from convention and look forward to the pleasure of being with you at future meetings. Sincerely hope your business sessions will be very profitable. Our thoughts this week are of you and the enjoyment we had together at previous conventions.

T. W. LOWE.

At our first session the Secretary reported new applications received would number at least 40 and 43 have been approved. Two have been held for proper classification. A motion to elect these members and ratify the action of the Board is necessary.

On motion of Mr. Laughbridge the action of the Executive Board was ratified.

THE CHAIRMAN: Has the Executive Board a report to make this morning?

MR. LAUGHRIDGE: The Executive Board held a meeting but a report has not yet been prepared. They would like to have the privilege of presenting it to-morrow.

THE CHAIRMAN: The next order of business will be the report of the committee on "Oxy-acetylene and Its Advantage in Boiler Repair," of which Mr. John Harthill is chairman.

REPORT OF COMMITTEE ON

"Oxy-Acetylene and Its Advantages in Boiler Repairs."

INTRODUCTION.

Your committee in presenting this paper will endeavor to cover Oxy-Acetylene welding and cutting in its many phases in a general way and we will avoid all mention of the Electric method.

THE APPARATUS:

The oxygen and acetylene is obtained in suitable containers for the use in the shop or the acetylene can be manufactured as used by a stationary plant from carbide.

In the stationary method the acetylene is piped from the accumulator through the shop to different stations and the oxygen is obtained in suitable containers and attached to a manifold and then piped through the shops to these stations. The gases are here combined in the torch. In this method low pressure gas is obtained. This is advantageous because a more even flow is obtained.

In the high pressure method oxygen and acetylene containers are mounted on a portable truck and the flow regulated by valves, the gas being again mixed in the torch.

USES:

Oxy-Acetylene is used in both welding and cutting, in boiler repairs and building.

WELDING:

The various kinds of welding work which can be done are as follows:

(1) WELDING FIRE-BOX SHEETS.

(a) Part side sheets and crown sheets. Exhibit (1) St. L. & S. F. R. R. welded back flue sheet to wrapper sheet.

TALMAGE SYSTEM
ASH-PANS

PATENTED

APPLICABLE TO ALL LOCOMOTIVES

THE TALMAGE MANUFACTURING CO.

CLEVELAND

J. G. TALMAGE, President.

Exhibit (2) N. Y. C. R. R. Collinwood shop. Welding crown sheets.

Exhibit (3) N. Y. C. R. R. Collinwood shops. Welded crown sheet finished.

(b) Welded-in door sheet and flue sheet to wrapper sheet without use of rivets above the mud ring.

Exhibit (4) A. C. L. R. R. Waycross shops. Flue sheet welded to side sheet.

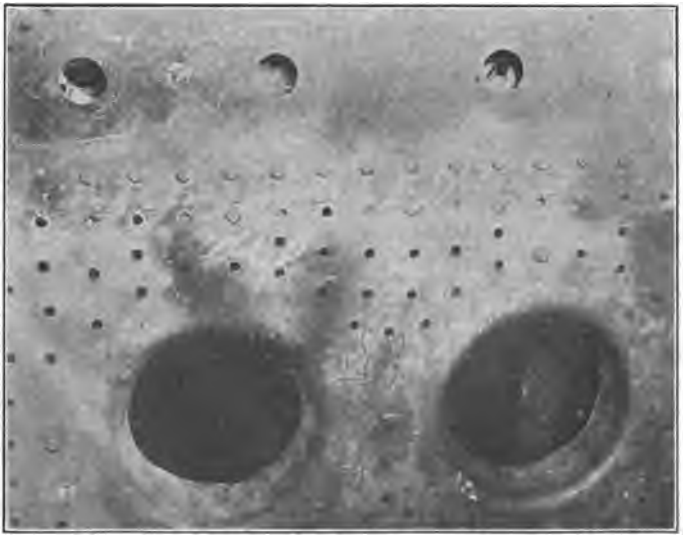
Exhibit (5) A. C. L. R. R. Waycross shop. Door sheet in place ready to weld to same firebox.

(2) DOOR SHEETS.

(a) ¾ door sheets.

Exhibit (6) N. Y. C. R. R. Collinwood shops ¾ door sheet ready to weld, sheet dropped ⅛ inch per foot.

Exhibit (7) N. Y. C. R. R. Collinwood shops. ¾ door sheet welded complete.

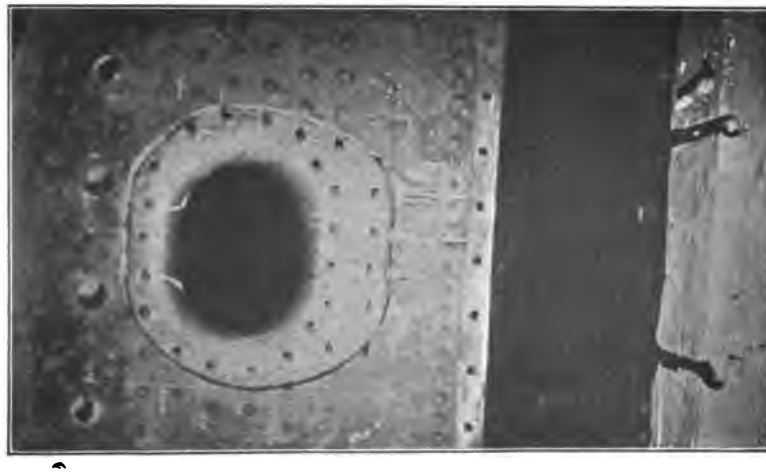


(b) Door holes and door sheets welded without rivets.

Exhibit (8) A. C. L. R. R. Waycross shop. Door patch and door collar welded to door sheet. This collar is also welded to back head around door hole.

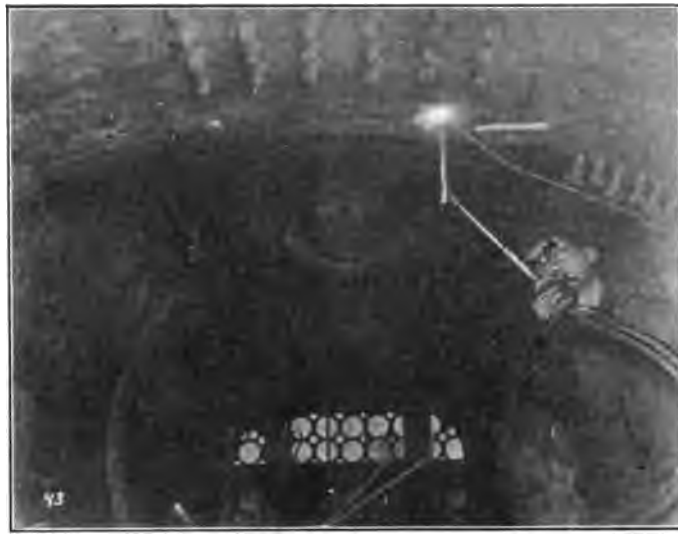
Exhibit (9) A. C. L. R. R. Waycross shop. Another type of door hole collar fitted to position ready to weld.

(3) PATCHES.



(a) Crown sheet patches.

Exhibit (10) N. Y. C. R. R. Collinwood shops. Welded patch on crown sheet overhead.



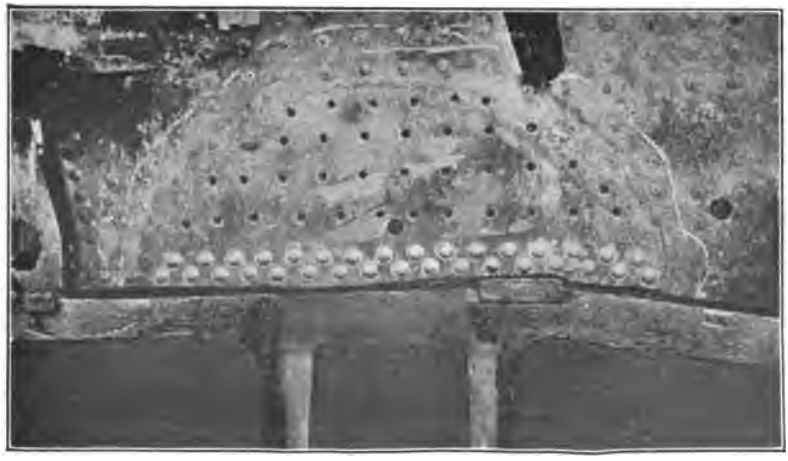
(b) Outside sheet.

Exhibit (11) Frisco Lines. Welded patch on outside wrapper sheet.

(4) MUD RINGS.

(a) Mud ring corners.
(b) Cracked mud rings.
(c) Filling worn spots in mud rings.

(5) FLUE SHEETS.



(a) Bottom half of front flue sheet where bridges have been cracked.

Exhibit (12) A. C. L. R. R. Waycross shop. Defective part of front flue sheet removed.

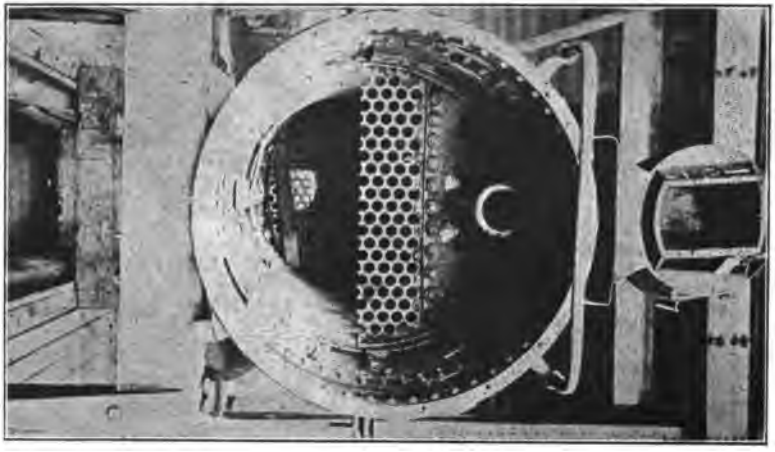
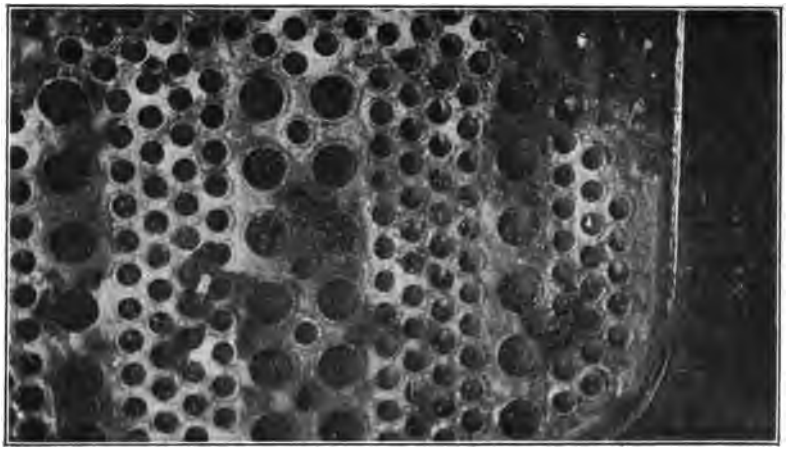


Exhibit (13) A. C. L. R. R. Waycross shop. New piece of front flue sheet ready to fit in place as shown in exhibit No. 12.

(b) Cracked bridges.

Exhibit (14) Frisco Lines. Welded cracked bridges in back flue sheet.

(c) Cracks in flange of flue sheet.



(6) FILLING.

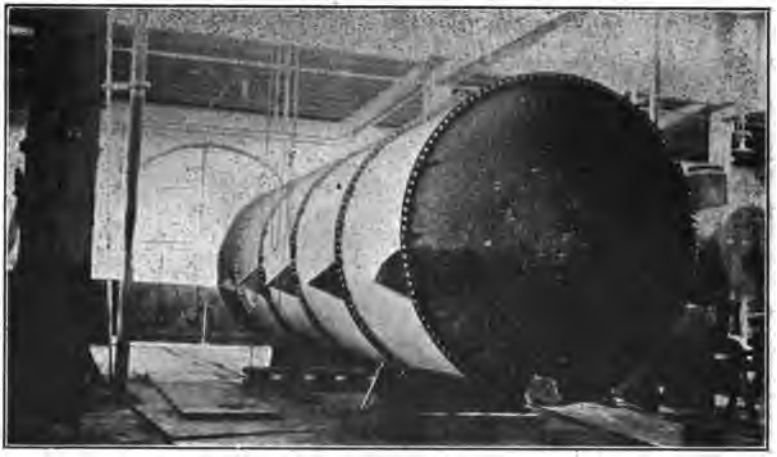
(a) Reducing size of wash out plugs and staybolt holes.
(b) Thin spots in sheets.
(c) Building up caulking edges to original thickness.

(7) MISCELLANEOUS.

(a) Oil tanks without seams.

Exhibit (15) Frisco Line. Oil tank for shipping oil on cars. 11,300 gal. tank. All longitudinal seams welded and tested at 65-lb. pressure.

Exhibit (16) Frisco Lines. Oil tank completed.



PREPARATION:

In preparing for general welding, the plates should be clean of all dirt and scale, then fitted together line to line as closely as possible. (Fig. a plate 1.) The plates are beveled to a 45-degree angle to the full thickness and bolted properly in place.

Two methods are followed. In some shops the plate is dropped ⅛ inch per foot while in others the plate is put in place and all rivets and staybolts applied before the welding is begun.

OPERATION:

The operator should take due care to have the proper mixture of the oxygen and the acetylene, which his experience will teach him. This is most easily told by seeing that he does not get a double cone on his oxygen flame and that his acetylene flame does not "sputter." In case he gets too much oxygen the plate will oxidize or burn and where too much acetylene is used the plate crystalizes or hardens. Due care must be taken to avoid a porous weld.

Plate I.

In welding the flame should be worked back and forth in such a way as to heat both sheets evenly and melt both at the same rate, until the edges are welded together as shown in Fig 6., Plate 1. After the sheets have been welded at the feather edge the V should be filled by applying the Swedish iron wire evenly until the V is filled up 1-16 inch above the surface of the plate, as shown in Fig. C, Plate No. 1. This is worked in spaces of about 2½ inches. Then go back and heat

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The hotter fire don't cause them to leak.

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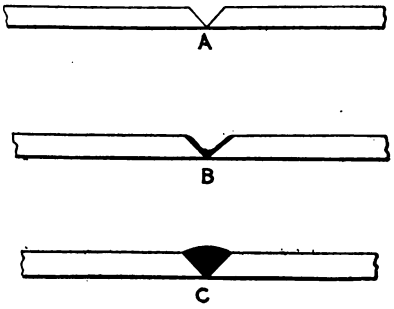
to a welding heat and fill in with wire. Some shops weld sheets at different points and then come back and make the weld continuous, while other shops weld straight along.



RESULTS:

By this method a five sheet box can be changed to a three sheet box, doing away with all running seams. In patch work it does away with patch bolts, rivets and plugs, also caulking edge. If due care is taken and a perfect weld obtained, the weld should last as long as the sheet.

CUTTING:

The Oxy-Acetylene may be used for cutting steel, cast steel and wrought iron. Its uses in boiler shops are as follows:

(1) Cutting out fire boxes all parts.

(2) Cutting out smoke stack holes and cylinder holes in smoke box.

(3) Cutting off staybolts for driving.

(4) Cutting seat boxes and running boards for pipe holes and appliances.

(5) Other uses too numerous to mention.

PREPARATION:

In preparing for cutting, the operator should see that all hoses are free from dirt, that the torches and gauges are in good operating condition, that the gases are so regulated as to produce a good cutting flame which experience soon teaches.

OPERATION:

After the torch is working satisfactorily to satisfy the operator, he holds it about ½ to ¾ of an inch from the metal to be cut and exercises due care in following all lines and marks made for his direction.

RESULTS:

The time in cutting can be reduced from 50 to 95 per cent. in any and all classes of work with which we come in contact in a locomotive boiler shop.

Your committee has avoided all mention of electric welding in this report as it is covered by another committee.

We are indebted to the following for the illustrations we have included: J. P. Malley, G. B. I., Frisco Lines; John Harthill, G. B. F., N. Y. C. R. R.; L. M. Stewart, F. B. M., A. C. L. R. R.

CONCLUSION:

It is the opinion of your committee that with a modern apparatus, competent and experienced welders and the proper facilities for handling the work, the results will be the best that are known in the modern boiler making art. Your committee predicts that within the next few years Oxy-Acetylene will be the standard practice in all boiler shops for the work we have covered and that many more uses will be found for it.

JOHN HARTHILL, Chairman
J. P. MALLEY,
L. M. STEWART,
R. W. CLARK,
Committee.

MR. HARTHILL: Your committee thought it would be better to show how the work was being done in the different shops, located in the different parts of the country, instead of having so much talk about it. We had hoped to have photographs here from about 14 large shops for examination, but they did not arrive. Oxy-acetylene welding, as your committee predicted, will be a modern art in boiler work for the next few years. Your attention is especially invited to this feature of our report.

(Mr. Harthill read the following statistics obtained after making tests of different methods of welding three-eighths inch plate by the oxy-acetylene process.)

Kind of Weld	Thickness of Weld	P. C. Increase of Weld	Tensile Strength	Elongation	Efficiency of Weld	Remarks
Original piece ..... No Weld	.390		59100	25.5	100	
Pieces loose and close together ...	.445	20.3	56520	11.0	95.6	slight traces of crystalization
Pieces tight with 1-8 inch opening.	.483	24.5	41650	4.0	70.5	slight traces of crystalization
Pieces tight with 1-4 inch opening.	.512	32.6	39820	2.5	67.4	slight traces of crystalization
Pieces tight with 3-8 inch opening.	.490	26.	34340	2.0	58.1	no traces of crystalization
Pieces tight with 1-2 inch opening.	.528	40.1	34630	2.0	58.6	slight traces of crystalization

I think that is all I have to say in opening this discussion, but I would like to hear from other members in regard to whether they have made any tests regarding the strength of weld as it is interesting to me.

THE PRESIDENT: We will suspend the regular order of business and go back. We have been honored in the past in being addressed by men prominent in the mechanical world, and this convention is to be no exception. We have with us to-day one who has not only established himself along the lines which he has chosen, but also established himself firmly along other lines. His ability cannot be better demonstrated than by the manner in which he has handled the office of which he is the chief. It is certainly a great pleasure for me to-day to introduce Mr. Frank McManamy, Chief Boiler Inspector of the Interstate Commerce Commission.

ADDRESS OF MR. FRANK McMANAMY.

Mr. President and Members of the Master Boiler Makers' Association.

When your convention in Chicago honored me by making me a member of the Master Boiler Makers' Association I was in hopes that I would be allowed to enjoy the privilege of all other members and attend your conventions simply as a member and not as a speaker; and I have no doubt many others indulged in the same hope. However, the success of the convention depends largely on the efforts of the members; therefore, I feel that it is my duty to perform any service required of me that will in any way be of benefit to the Association.

The purpose of this Association as expressed in the by-laws, and the work of the Locomotive Inspection Bureau, are to a certain extent identical, and their interests to the same extent are, or should be, mutual; therefore, I feel when talking to you more like one of your committees who is making a report than a Federal official who is addressing your meeting.

The Master Boiler Makers' Association is to be congratulated on its remarkable growth during the 10 years that it has been in existence, and the attendance at this convention as shown by the register indicates a successful meeting. Members should realize that simply coming to the convention does not fulfill all of the duties of membership. Successful conventions can only be held where the members attend all of the sessions, are on time at each meeting, and furnish whatever information they may have with respect to the subjects under discussion.

Article 2 of the by-laws of the Association reads as follows:

> "The objects of this Association shall be the mutual improvement of its members by an exchange of ideas in meetings, the reading and discussion of papers, and a general interchange of views, so that all may profit by the experience of others more proficient in our craft."

The objects of the Association therefore are commendable, and the question for each member to answer for himself is, "how can they best be served?"

A review of the subjects discussed by this convention at its various meetings indicates that much constructive work may be accomplished by this Association. Its value, however, will be largely if not entirely governed by the accuracy and reliability of the reports submitted, on which the action of the convention is based. Nothing will do more to prevent this Association from attaining its legitimate and proper position as a leader amongst authorities on boiler work than presenting matter to the convention as the conclusions of committees that is not based on actual and accurate tests or performance records.

Interest in meetings is another essential to a successful convention; therefore, every member should take an active interest in the discussion of various subjects with a view to both giving and absorbing as much information as possible. We hear much about interesting meetings, but the one sure way to have interesting meetings is to take an interest in them. It is almost invariably true that the man who finds nothing of interest in the discussion of subjects at a convention of this kind is the man who has absolutely nothing to offer to interest others.

The selection of subjects for discussion has an important bearing on the work of the convention, and care should be exercised to select subjects of general interest, which will prompt discussions along the lines of progress. Your committee which has charge of this is to be congratulated on their efforts in this direction.

Many factors must be considered in connection with the successful operation of large modern locomotives and high speed trains, but none are more essential both to speed and safety than the condition of the locomotive boiler. It would be an injustice to the many other classes of reliable efficient railroad employees who are faithfully and earnestly laboring, not only to maintain, but to improve the wonderful transportation system of the country, to say that the work of the boiler maker is the all important factor. It is true it is highly important to have a properly designed, well constructed and maintained boiler, because locomotives can not be operated without steam. It is equally true that no matter how efficient the boiler, without properly designed, constructed and maintained cylinders, wheels and other mechanism you do not have a locomotive. It is also true that no matter how efficient the locomotive, if it is not properly operated it may be a source of danger, rather than an efficient servant. Therefore, it would doubtless be improper for any one class of employees to claim pre-eminence.

On the other hand, no one should underestimate the importance of the duties he is performing, because better work will always be done by an employee with a keen sense of its importance, and turning out a locomotive with a poor boiler is about the same as erecting an expensive building on a poor foundation.

The duties and responsibilities of the foreman or master boiler maker are constantly increasing, and it is necessary for men who fill those positions to broaden out and take advantage of every opportunity that is offered to improve and to learn the best methods of doing their work. Constant effort and study are required to keep up with the march of progress; therefore, meetings of this kind are of value, not only to the master boiler maker who attends them, but to the company by which he is employed.

Meeting and becoming better acquainted with fellow craftsmen from other roads, and discussing matters of mutual interest, not only

results in accumulating new ideas, but it fills men with enthusiasm and makes them more eager to perform their work in the best and most up to date manner.

One of the best advertised movements in the railroad world today is what has come to be known as the Safety First movement. Many of us here have been in railroad service when comparatively little attention was paid to the safety of employees, and looking after himself was considered a part of the employee's duty. Something over 25 years ago the number of men killed and injured in railroad service began to attract the attention of the public, and movements were started by the employees to obtain the passage of laws for the promotion of safety for railroad men. Strong opposition was encountered from sources where suport for the movement might have reasonably been expected, and it was only after a number of years spent in the work and after a number of laws had been passed and enforced to an extent which proved that it not only was a protection to their employees, but it was actually cheaper to protect employees than it was to pay for their injuries, that the movement was actively taken up by the railroad companies under the slogan of "Safety First."

It will perhaps surprise most of you to know that the records of the Interstate Commerce Commission show that during the last 25 years 223,721 persons were killed and 2,184,339 injured in railroad accidents, and that before the slogan "Safety First" was ever heard more than one million railroad employees had been killed or injured in their daily work.

Do not understand me as criticizing the Safety First movement. Far from it. The movement, belated as it was on the part of the railroads, is welcome. Where it is sincerely observed it is a boon to both the railroads and their employees, and is doing much to prevent accidents. As one railroad which is a pioneer and one of the most consistent advocates of the safety movement puts it, "It takes less time to prevent an accident than it does to report one."

In fact, where "Safety First" has been actually made a part of the principle on which a railroad is operated, instead of simply being given a place in its advertising literature, it has proven so profitable that it is being extended even to the handling of freight, a recent report to the American Railway Association by their Committee on Packing, Marking and Handling of Freight showing that during 1915 a saving of $7,626,519 was made on 112 railroads by the adoption of Safety First methods. If such results as this can be accomplished in the handling of freight, surely the movement as applied to employees is worthy of our best efforts.

It may be asked, "What can this convention or its members do to promote safety?" The answer is, "It can do a great deal." It is true it represents but one branch of railroad work, but it is an important branch. The men of whom this Association is composed have charge of large shops and many workmen who are engaged in the construction and maintenance of locomotive boilers and their appurtenances, and are therefore responsible in a great measure for the safety, not only of the workmen who construct, but those who operate the product. No industrial operation is of sufficient importance to justify the unnecessary loss of human life in its accomplishment.

The purpose of the locomotive boiler inspection law and of the amendment thereto was to promote safety. The organization created thereby represents but a small part of the work which the Federal

Government is doing for the protection of life and limb. In its particular field, however, remarkable progress has been made, and while I am not going to take up the time of this convention in reading a complete record of the work performed and the results accomplished by the law, a general summary thereof will be of interest.

During the first four years the Federal locomotive boiler inspection law was in force 330,739 locomotives were inspected by Government Inspectors, 13,445 of which were found to be in violation of the law and were ordered out of service for repairs. The result of this work is best shown by a comparison of the number killed and injured during the first and fourth years under the law. During the year ended June 30, 1912, there were 856 accidents caused by failure of locomotive boilers or their appurtenances, resulting in 91 killed and 1,005 injured. During the year ended June 30, 1915, there were 424 such accidents, which resulted in 13 killed and 467 injured, a decrease in four years of 48 per cent. in the number of accidents, 87 per cent in the number killed, and 53 per cent. in the number injured. The records for the first nine months of the current year in comparison with the corresponding period for the previous years, shows a further decrease in the number of accidents and in the total number of casualities; the number killed is somewhat greater than for the preceding year, but is still below the average. This is especially noteworthy in view of the strain on the railroads, their equipment and their employees due to the unprecedented volume of traffic during the past year, and conclusively shows not only the importance of, but the results which follow Federal supervision over locomotive equipment.

We do not attempt to make the claim that the Federal Inspectors are responsible for all of this improvement. We will claim, however, until a similar improvement is shown in some branch of railroad service that is not covered by the law, that the Federal law is responsible therefor.

I have given these comparisons between the years ended June 30, 1912, and June 30, 1915, because of a change in the Federal laws which will make it difficult to continue the comparison on the same basis. I refer to the amendment of March 4, 1915, extending the work of the Federal Inspectors to the entire locomotive and tender, as well as to the locomotive boiler and its appurtenances; and in order that our position in this matter may be entirely clear, I will say that this amendment made absolutely no change in the Federal locomotive boiler inspection law, and none in the method of its enforcement. It is true it added to the duties of Federal Inspectors, and perhaps will make it impossible for them to inspect so many locomotives, but no change will be made in the method of handling the work under the locomotive inspection law.

The Locomotive Boiler Inspection Bureau in its relation to the railroads has always taken the position that the work of preventing accidents and promoting safety to employees and the traveling public can only be successfully accomplished where genuine and intelligent interest and hearty co-operation between the railroad, their employees and the Government exists, for which coercive measures are but a poor substitute. It must not be assumed from this, however, that the question of co-operating with us in this work, and to what extent, will be left to the discretion of the railroads. Where such co-operation is not voluntarily given or is only given when no expense or delay to equipment is caused thereby, then the power that is conferred

EXECUTIVE BOARD.

Left to right: A. N. Lucas, B. F. Sarver, John F. Raps.
Center: Harry F. Weldin, Thomas F. Powers, Chairman, W. H. Laughridge, Secretary.
Bottom: W. H. Harthill, John Wintersteen, L. M. Stewart.

on us by law will unhesitatingly be used to accomplish the purpose intended.

It is but fair to say, however, that a large percentage of the railroads are co-operating with us to a very great extent, otherwise such wonderful results in the prevention of accidents could not have been accomplished, and as the beneficial results of the law become more and more obvious, co-operation is more unreservedly and wholeheartedly given.

The primary purpose of this convention is not to listen to addresses; therefore, I do not feel that I should take any more of your time away from the many important matters which are yet to come up for discussion. I am glad to be able to be with you, and I confidently predict and hope for the most successful convention that the Master Boiler Makers' Association has ever held.

THE PRESIDENT: I will call on Past President M. O'Connor to respond.

RESPONSE OF PAST PRESIDENT M. O'CONNOR.

Mr. McManamy, Mr. President and Gentlemen:

After listening to the address of our good friend and honored member of our Association, I concluded that it would probably be agreeable to the convention, and surely to myself, to cut my remarks very short. I know the value of time and the amount of work as well as the important subjects we have before us. I am satisfied that the interest that has been taken in conjunction with the Federal Laws is mutual in all respects . A few years ago when the law took effect it was a little technical, but that has passed and we now invite the Federal boiler inspectors to come to our shops and examine our locomotives, and see the class of work and how it is being done. If he finds the work carried out according to his instructions and legal requirements, it is so much to our credit and to the man higher up. That is the correct system and the only way in which to progress—to do things and do them according to requirements of the law. The Federal boiler inspector and the master boiler maker being mutually connected in the line of duty, it is very easy to meet the requirements.

I wish to say to Mr. McManamy in behalf of the Association that we are to be congratulated on having him with us this year; we appreciate his address; it is very educational and we will go back to our homes and know that while here at the convention we have the sentiments of the Federal Chief as well as of others, not only on the government side of it, but in everything coming before this convention. So in behalf of the Master Boiler Makers' Association I wish to thank him very much for the remarks he has made this morning. (Applause.)

MR. LAUGHRIDGE: In expressing our appreciation of the valuable paper of Mr. McManamy, it seems to me that we should do so by a rising vote.

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The motion being seconded, a rising vote was tendered Mr. McManamy.

DISCUSSION OF OXY-ACETYLENE RESUMED.

THE PRESIDENT: We will now return to the regular order of business I believe Mr. Hodges has a paper he wishes to read.

ECONOMIC ADVANTAGES OF OXY-ACETYLENE WELDING.

BY A. R. HODGES.

It is not my purpose to deal with the origin and development of Oxy-acetylene welding, neither is it necessary to discuss its wide application, which is unlimited, nor do I intend to tell you in detail, or as a whole, how to make various classes of repairs by this method. But I wish to speak of its economic advantages as a general proposition.

In the first place, it is a decided advantage in the subsequent upkeep and the maintenance of the locomotive in an efficient serviceable condition. Under the old method of boiler work and engine repairs, leaky seams and rivets and defective side sheet patches, as well as many broken parts of engine and tender, rendered the locomotive incapable of efficient performance, and gave it decided disadvantage. But the oxy-acetylene welding process employed in boiler repairs completely eliminates all seams and rivets exposed to the direct attack of fire, and when patches are applied restores the plates to the original smooth surface; the life of the fire box is increased 100 per cent., and an original fire box applied by this method will last longer and render better service than when applied by the old method. This being true, it logically follows, therefore, that the outside casing sheet and back end of boiler is conserved accordingly. Therefore, leaky fire boxes from these sources, having caused so much trouble in the past and impaired the efficient performance of the locomotive, with a high cost of maintenance, are entirely overcome. Moreover, engine parts having broken, and become otherwise defective, making it necessary to remove the engine from service to effect repairs, which are performed effectively, and I might say, permanently, during regular layover in terminals.

I have comparative data which abundantly bears me out in this assertion, and the decrease in engine failures due to steam leaks establishes this fact beyond a doubt. Not only this, but repairs performed by this process to engine and tender make it possible to secure almost any mileage expected from the locomotive and the betterment of equipment will reach a higher percentage than can be obtained otherwise.

Then again, it is proving an advantage in making repairs to locomotives with great rapidity, thus reducing to a minimum the time an engine is held out of service for repairs. Under the old method, at its best, repairing boilers was a very slow process, requiring a great deal of time and of men, so that "we are waiting on the boiler makers" was a universal cry and the output of the shop was in a large measure dependent upon the Boiler Department. With the oxy-acetylene welding and cutting process, the rapidity with which boiler repairs

are accomplished, removes this obstruction to shop output from the Boiler Department and makes an equal distribution of responsibility upon all departments, in addition to a minimum, reducing the time the engine is held for repairs. Then again, the heavy tonnage hauled, and the fast speed attained, is proving very trying on the engine parts, especially the frames. During the last 15 months we have had no less than 45 broken engine frames. This applies to one Division which maintains 138 locomotives. Under the old method of repairing this would have caused an enormous delay, even with splendid shop facilities of which we have been denied, besides compelling so many engines to be out of service. This, alone, would have forced a burden on us entirely too great. We would have been compelled to send these engines to the general shops for repairs, and they in turn would have been obliged to furnish us with other power. With the oxy-acetylene welding process, all these engines have been handled in the Memphis terminals; and if a broken frame constituted the major trouble, only three days were necessary to make repairs and return the engine to service.

Another reason why oxy-acetylene welding is an advantage is, it eliminates the necessity of maintaining a large margin of power to handle the traffic, reducing it, therefore, to a minimum. Under the old order, a large margin of power was essential, due to the fact that engines were held in shops an excessive length of time while undergoing repairs. It followed, therefore, that other power had to be substituted, and this was not always possible. If the system embraced many divisions the demand often proved greater than the supply. If the general shop was of sufficient capacity to handle the engines sent in from the various divisions with practically no delay, even then a goodly margin would be necessary; but if not, a congestion of power would be inevitable, which is almost invariably the case. This being true, each division Master Mechanic held his engines in service just as long as possible, before shopping, and when shopped, they would be outlawed from end to end. You can see at a glance that this is improper maintenance, and to overcome this improper handling a large margin of power is absolutely necessary. But with the oxy-acetylene welding process it is made possible to do extensive repairs to both boiler and machinery in a very short time, and should be properly termed running repairs, with no shopping charged to the engine. When locomotives are thus maintained, and it can be done, the large margin of power necessary can be reduced to a minimum. Every engine tied up in the shop for repairs for a longer time than it should be, on account of antiquated methods, is simply dead weight, representing a small fortune from which the management receives no returns whatever. Here is invested capital from which there is no dividend at all. But with oxy-acetylene welding in stripping engines and rebuilding them, deadweight of deposited capital will be put into circulation, from which legitimate revenue will be derived.

The next advantage derived from oxy-acetylene welding and cutting process is that heavy boiler and engine repairs can be made in a small locality with meager facilities and a limited shop capacity. In 1911, the Federal Government demanded that common carriers engaged in interstate commerce maintain their locomotive boilers in a safe and suitable condition for service. This demand had to be met. The boiler department received an impetus and a consideration previously unknown. Men had to be employed and tools bought. Many local, and even some general shops, had to be enlarged. The Federal

Government noting the beneficient results which followed decided that it would be wise ,and equally beneficial, to enlarge the scope of this law so that it would cover the engine and tender, thus making it obligatory upon the part of these common carriers to maintain the entire locomotive in the condition described. This demand will have to be met in conjunction with the other. The engine will not be permitted to go into service at the option of the Roundhouse Foreman, Master Mechanic, or any other official, unless fit for service as per the standard requirements of the Government. Locomotives will not be permitted to run down and go to pieces before shopping. They must be kept up. To do this, it will require live men as Foremen. The human element is the first factor to be considered in all advanced moves. The next is advanced methods which will enable the company to perform repairs with great rapidity. Oxy-acetylene welding, which has been fully developed to meet the demand of the boiler, has proven equally effective in meeting the demands of the engine. This process properly installed in a shop and efficiently supervised with meager facilities and shop capacity, will prove a mighty factor in meeting the demands of the Federal Government in maintaining the power in serviceable condition, with minimum cost and delay, at the same time localizing the repairs and relieving General Shops of their burden.

Another advantage resultant from oxy-acetylene welding is the marvelous savings effected in the reclamation of otherwise scrap material. This is accomplished in many instances without the necessity of removing castings, channel bars, I beams, or plates from the locomotive. To supply a railway system with material, and maintain only a minimum stock, yet having sufficient to meet all demands from all departments, has always been a stupendous undertaking, but never so difficult as at the present time. Heavy power, increased tonnage, steel equipment, and safety appliances, of today has created a demand for material little dreamed of in the early days of railroading. Rolling mills, steel and cast iron foundries, and others, have endeavored to meet this demand, but the European conflict has in large measure diverted the stream of supply into other channels, and home consumption, therefore, has been compelled to economize greatly in the material line or do without. Some method by which defective material while in service could be redeemed, or, at least, its life prolonged, and otherwise scrap material reclaimed has been an absolute necessity. The ingenuity and resourcefulness of the American railroad man has never been so fully and conclusively demonstrated as in this instance. With the oxy-acetylene welding and cutting torch he transforms scrap piles into storehouses of serviceable material, and extends the life of finished and applied equipment 50, 75, and in multiplied instances, to 100 per cent. This is no fancy sketch, neither do I wish to draw on your imagination, but I am relating to you, facts culled from practical experience, and am speaking, therefore, from *personal knowledge.*

Many other advantages are attached to the oxy-acetylene cutting and welding process, but I only wish to mention just one more.

It eliminates the use of a great many tools, reduces the demand for pneumatic hammers and motors and makes it possible to produce high speed lathe tools at a greatly reduced cost. No argument is necessary to prove this as it is a logical conclusion, for it naturally

follows that if a new method of performing work has been developed, that old methods and tool usage have been curtailed in a measure. Now mind you, oxy-acetylene welding and cutting is not a supplanter or a substitute, but an innovation of mechanical skill and superabounding with economic advantage. The old, which proved good under test, will remain and that which failed to meet the demand is the field which oxy-acetylene welding is trying to enter and strengthen. Thus, as a whole, we march along in victorious triumph and rejoice together over successful achievements, knowing that we have contributed our part to lighten the burden of our fellow toilers, make possible the success of our employers, and assure the public that their interest is our concern; that we are endeavoring with our combined skill, to construct a boiler which will stand the test, an engine which will not fail, an equipment which in service is unsurpassed, and in comfort unequaled in safety beyond a doubt.

MR. POWERS: I move that no man be allowed over five minutes on each subject, or be allowed to talk twice on the same subject until everyone has had a chance. Motion seconded.

MR. D. A. LUCAS: I wish to offer an objection to that. Many times a point comes up, a very essential point, which I think a man should be allowed to speak on. We come here for information and we want to get the best there is. Motion carried.

MR. D. A. LUCAS: I have listened to Mr. Harthill's report, and think it very good. I have not much to offer, but I feel as though I was one of the pioneers in oxy-acetylene welding and I am glad to see that the boiler makers have grasped the situation. I find that not all of the trouble is with the welder. We had a good deal of trouble with the operators, but much depends on the material. I have made tests and found to my satisfaction a good percentage of the failures is caused by material. While we established a record and gone along all right, under the same process, we began to have failures. On investigation we found we were not getting the metal that we had previously for that work and I have tested out the different welds in several ways. The most efficient test was preparing two jobs of the same character which were given to two different welders. Neither pulled the same so it was either in the material or in the operator. They did not stand the same test. We began the oxy-acetylene process in 1910 and are still finding new fields every day for its use. I think it has come to stay and is one of the best things we have had in boiler making for several years.

MR. STEWART: We have been welding with oxy-acetylene since 1910. and believe we have passed the experimental stage. We have been doing such work as is shown by the illustrations in the report with excellent results. For the past two years we have been welding

fire boxes complete, and so far have had no failures from the welds. You will note that one cut shows the flue sheet welded on both sides on account of the movement of the sheet from expanding the flues. We weld the flue and door sheet flanges to the side and crown sheets, also the door sheet to back head around the fire door. We weld the side sheets and never drop them for expansion. That is one thing on which the committee did not agree. We put in the side sheets, bolt to mud ring, apply all staybolts, then weld the sheets, always welding the ends first, after which we drive the mud ring rivets and staybolts. I notice it is not the practice of several shops to weld the side sheets to the flanges. We generally find defective flanges as well as defective side sheets. We burn off behind the rivets and weld as it is too slow and expensive to rivet them.

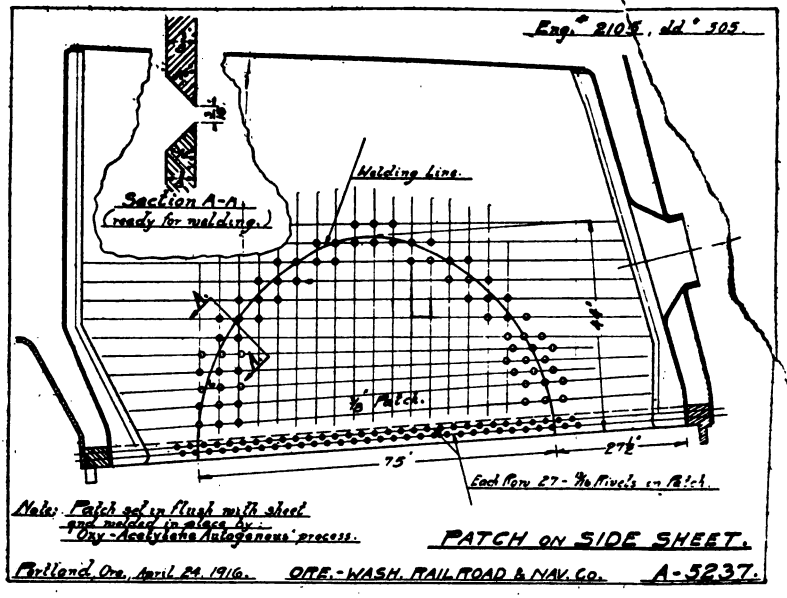
As to applying crown sheet failures from low water, we do it very often. It is an overhead weld and we have splendid success in that operation. We also weld our narrow fire boxes in five pieces. We find this operation is a great saving over the old methods of riveting. We weld sections of front flue sheets. We burn off the defective part of the sheet through the bridges, put in a new piece of sheet, and weld back through the bridges. We find that is a great saving over the old method of handling the boxes. We weld front flue sheets on small engines where we don't care to spend much money. We burn off the bridges, put in a new sheet and weld back the bridges.

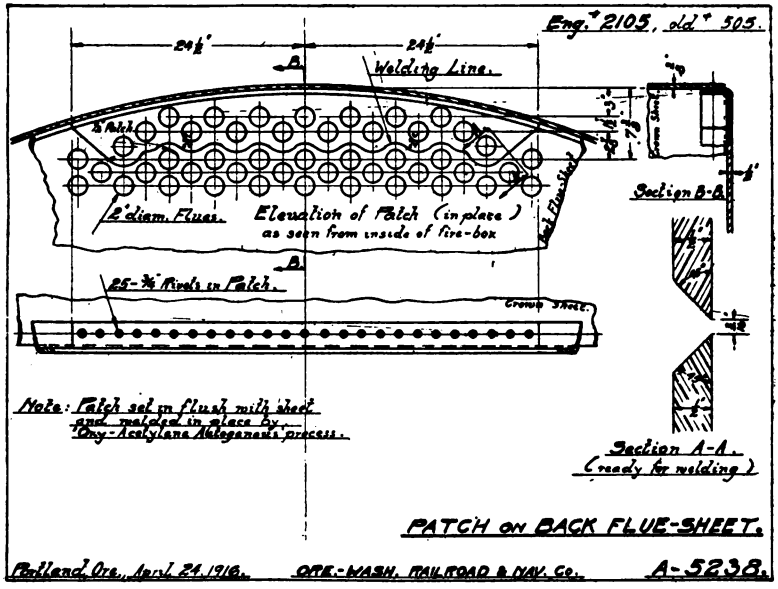
MR. PATRICK: Do you use any special material?

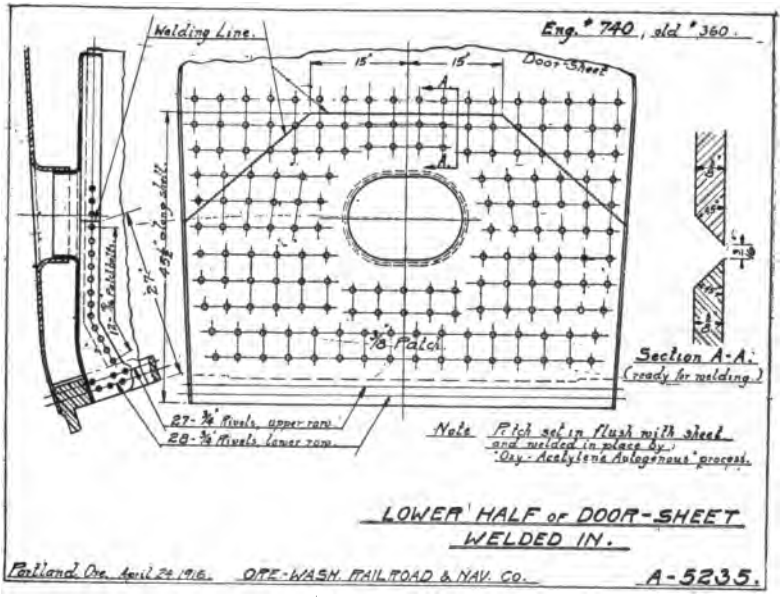
MR. STEWART: Yes, we use a special material, made by a special process.

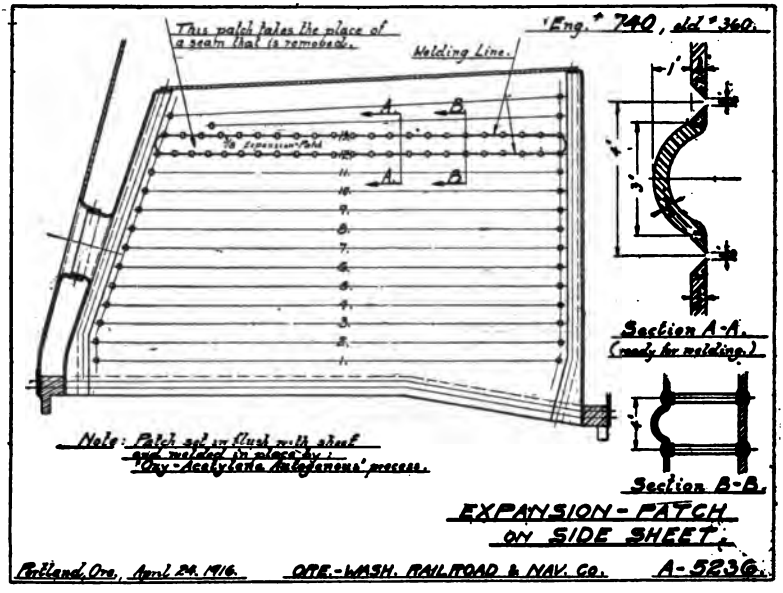
MR. WESTOVER: We have been using the oxy-acetylene process for the past three years. I have heard several members of this association talking in groups in regard to the work they are doing, and I would like to make known the work we are doing in the Northwest. We have a heavy class of power, namely Mikado and Consolidated type of engines, and we have experienced trouble with the top flange cracking in back flue sheets. The old method was to plug up a number of flue holes to get a rivet seam for the patch, loosening a large number of flues and putting larger stress on flange and front flue sheet braces, which could only be overcome by applying long stay rods to the sheets. Since we have had the oxy-acetylene process we have successfully welded in these patches coming as low as 18 inches from the top of the flange on the face of the sheet, and then again applying all flues. We also have experienced trouble with the five piece fire box leaking in the longitudinal seams. We cut out longitudinal seams in the stay bolt line above and below the seam,

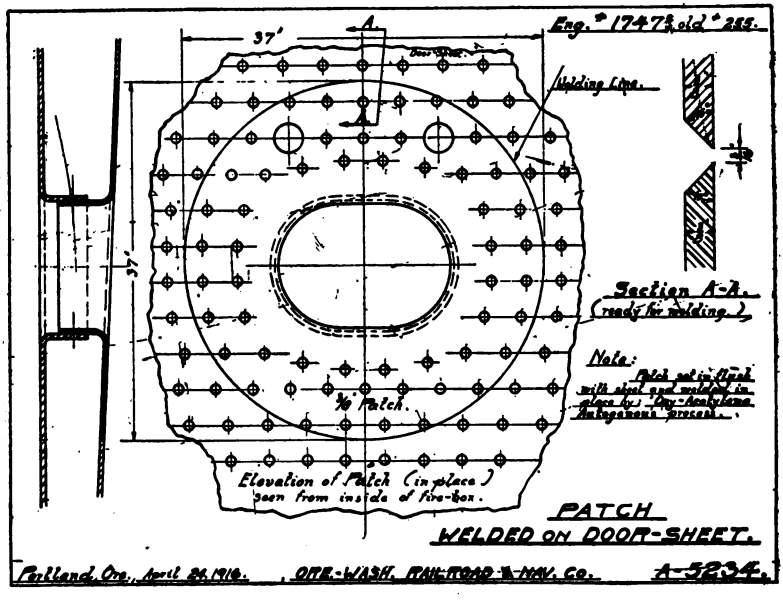
dish a piece of new material one inch and set in and weld. This has proven successful. I also had the honor of welding in the first patch on a steam boat boiler in the port of Portland. It brought me in contact with the Federal Marine Laws which are very rigid. Mr. Fuller, who was Chief Inspector, made us produce physical tests of welds before allowing us to proceed with the job. The physical test of the weld showed nearly 100 per cent. I have several times inspected marine boilers and advised on the welding. I have several drawings of the work done and would be glad to show them to any member. If you will write me, I will be glad to send any of you a drawing and tell you what we are doing.




Eng.° 2105, old° 505.
24½"
24½"
Welding Line.
A
B
2" diam. Flues.
Elevation of Patch (in place) as seen from inside of fire-box
25-¾" Rivets in Patch.
Crown Sheet.
Section B-B.
Section A-A. (ready for welding)
Note: Patch set in flush with sheet and welded in place by Oxy-Acetylene Autogenous process.
PATCH ON BACK FLUE-SHEET.
Portland, Ore., April 24, 1916. ORE.-WASH. RAILROAD & NAV. Co. A-5238.


Eng.° 740, old° 360.
Welding Line.
15"
15"
Door Sheet
A
A
⅜ Patch.
Section A-A. (ready for welding)
27-¾" Rivets, upper row.
28-¾" Rivets, lower row.
Note Patch set in flush with sheet and welded in place by Oxy-Acetylene Autogenous process.
LOWER HALF OF DOOR-SHEET WELDED IN.
Portland, Ore. April 24 1916. ORE-WASH. RAILROAD & NAV. Co. A-5235.


This patch takes the place of a seam that is removed.
Holding Line.
Eng.° 740, old° 360.
Section A-A.
(ready for welding.)
Section B-B.
Note: Patch set in flush with shell and welded in place by the Oxy-Acetylene Autogenous process.
EXPANSION-PATCH ON SIDE SHEET.
Portland, Ore., April 24, 1916. ORE.-WASH. RAILROAD & NAV. CO. A-5236.


37"
Eng.° 17473, old° 255.
Holding Line.
Section A-A.
(ready for welding.)
Note: Patch set in flush with shell and welded in place by the Oxy-Acetylene Autogenous process.
½ Patch.
Elevation of Patch (in place) seen from inside of fire-box.
PATCH WELDED ON DOOR-SHEET.
Portland, Ore., April 24, 1916. ORE.-WASH. RAILROAD & NAV. CO. A-5234.

MR. THOMAS LEWIS: At the convention a year ago I made a few remarks upon this subject and I have come to the conclusion now that we have passed the experimental stage. Our vice-president states that he is one of the pioneers in this work. Well, I don't want to dispute that fact or statement. However, I believe it was in our shop the first complete new firebox was welded. That was done possibly three yars ago and that engine is now in service and has been continually in service with the exception of when the flues were changed. No boiler work has been done on that engine with the exception of taking care of the staybolts and the flues. We have practically eliminated what are known as fire cracks in the riveted seams. We are doing at the present time practically all of our firebox work. I don't think we are now putting in any new fireboxes in the old way; that is riveting the door sheets and the flue sheets. They are all welded. I have in my hand a photographic picture of another firebox that we have recently done and are doing to-day with a combustion chamber in it. I believe that the combustion chamber is about 48 inches deep. That firebox with the combustion chamber is practically one piece. Everything is welded. No rivets are applied except at the mudring. We have six of these engines with these fireboxes in service. The first one I think has been out about three months and is giving entire satisfaction. It has been part of my duty to follow up this work and make inquiries at the different terminals where the engines were returned, and I have made a personal inspection to see whether any leaks were developing. I feel confident and glad to tell you that up to the present time I have found no leaks or bad defects. It would only take up your time if I were to tell you all the kinds of boiler work we are doing with the oxy-acetylene welding apparatus. I don't know that I could say anything more than what the last speaker did. We make all kinds of repairs and we have practically eliminated the seams in the fireboxes, even patches.

THE PRESIDENT: Mr. Pratt, of the Chicago & Northwestern, is with us, and I believe he would like to make a few remarks on this subject. Mr. Pratt, you will please come forward.

MR. PRATT: When you send a boiler maker out on the road you expect him to take his tools with him and I thought it would be no more than right to bring my pack with me in case there was anything to do. Some of the members may remember that last year I dropped in on the convention at the opening session, I thought I could learn something, and I did learn that the Mayor of Chicago went back on you and also the man who was to make the opening address. As I roped in for both of these remarkable stunts, I

thought I would be cute enough this year to stay away the first day, and only arrived this morning.

I have been interested in the affairs and proceedings of this Association for a number of years; I have been on various boiler committees for the different associations of which I have been a member. The Master Mechanics' Association's work with regard to boilers interested me very greatly and I was a member of that committee; I was honored a little more highly by that Association until during the present year I was elected their President, and therefore graduated from committee work, but my interest in boiler problems is still very great, as in my opinion that is the paramount problem of the steam locomotive, and I want to tell you that to-day my interest has not waned in the slightest. Unquestionably the requirements for the engine part of the steam locomotive are severe and those requirements will be advanced from time to time; but I believe it is the general consensus of opinion of the thinkers in the railroad world to-day that the greatest opportunity is in the boiler; nor have those advantageous matters been entirely overlooked.

The advent of the superheater seemed for a time to overcome or offset some of the advantages that had been gained by compounding; so much so that many, perhaps the majority of the designers, abandoned the principle of compounding the steam in the cylinder, to obtain the greater expansion, and adopted the superheat, which gave equal if not greater economies. Now that the superheater is, I might say, a standard of most locomotives, not excepting switch engines, some thought is again being given to the steam economies of compounding; however, when you see the large locomotive boilers of to-day with a stack just appearing above the top of the shell, with a firebox extending so close to the driver that there is no room for the ashpan, so close to the trailers (because the trailer has had to be substituted for the driver to give the firebox clearance), that you could scarcely use anything except powdered fuel or oil, it looks to me as though the chance for improvement to-day is greater in locomotive boilers than any other part of the steam locomotive. Last week in Chicago there was a convention of the International Railway Fuel Association. No association of railway men with which I am acquainted is without interests overlapping others. Subjects were touched upon at the Fuel Association convention that would be remarkably interesting to you gentlemen, but no one subject was more interesting to that whole convention than the matter of powdered fuel. On the Chicago & Northwestern Railway, with which I am connected, we are using an Atlantic type locomotive so equipped; a little less than a year ago, and after considerable experimental work during which we used various grades of coal, dried and pulverized. This engine is operating between Chicago and Milwaukee in passenger service on one of the fastest train schedules

in the world, and the fuel problems we have worked out on that locomotive are very interesting; they were interesting to every member of the fuel association. We had many boiler men in attendance at that convention. I merely mention this to show you gentlemen the responsibilities that are upon you individually as well as an association for the advancement of the steam locomotive, in order to prevent any further intrusion of the electric locomotive.

I hope you will pardon me for diverting your attention slightly from the original subject. I have two or three samples here to show you, as they pertain somewhat to the subject at hand. I hope that before this subject is closed some of the members who have had success in welding flues in the back flue sheet in bad water districts will explain just how they accomplished it. On the Chicago & Northwestern Railway we were over-enthusiastic in the welding of flues, and we imagined that of all our past troubles the greatest perhaps was leaky flues in bad water districts. We thought that just as soon as we welded those flues our troubles would all be over, but we have found almost the reverse of that; there has been trouble with the welded flues, particularly in the small flues. In the good water districts, it is a grand success, but where we welded them in the bad water districts, unfortunately it has not been successful. We have made a few experiments and I have here several samples of welds we have made. This one shows a recess in the back flue sheet in which the beads were turned and then it was welded over, showing a thorough soldering of the joints between the flue sheets and the turned end of the flues. The idea was to make so firm a connection between the flue sheets and the flue that you can prosser them about to the limit with your expander without breaking the weld loose between the flue sheet and the flue. We believe that the reason we have trouble in the ordinary welding of flues in back flue sheets in poor water districts is because the scale accumulates on the flue and we do not knock it loose as we do in the ordinary expanding of the flues. You appreciate that these experiments here are very primitive. Gentlemen are probably on the floor who have gone so much further than we have—this is just a few weeks old—that it will be very interesting for me to have those who have the information, convey it to me as well as to others who are listening. This other piece shows that when the flues are to be removed it is only necessary to chip off the weld and the flues will come out without damage to the flue sheet. I did not hear the original paper, and I did not hear anyone say what they are doing with regard to welding up pitted spots in two inch and larger flues, or whether they are doing that altogether with oxy-acetylene. It is such an extended proposition on the Chicago & Northwestern, where we have bad water, that pits badly. So it would be interesting to have that brought out—pitting and grooving. This exhibit which I hold

in my hand was brought into the office yesterday morning and shows the piece of flue that was left. It is entirely eaten away and there appeared to be no grooving elsewhere in this flue. It seems to me that pitting and grooving is another proposition that you gentlemen will have to solve sooner or later; that every possible theory advanced should be run to earth, as this is a cause of tremendous expense and difficulty to the railroads to-day and should be overcome in some way. I want to thank you for the opportunity I have had this morning of speaking to you. I am glad to be here for a little while to-day. I hope you will have a most successful convention. I don't doubt you will because I am very well acquainted with the man who is presiding—he is a remarkably able man. I thank you. (Applause.)

MR. WANDBERG: We are doing considerable oxy-acetylene welding, but I feel that success or failure is due largely to welders. They cannot be hired. They must be trained for the work, and it takes time. We have had trouble in our Purchasing Department buying the proper material. We have had failures just the same as Mr. Lewis and I believe that every man who has charge of welders should pay special attention to them. We do everything in the line of welding the firebox except putting in of fireboxes; we weld half sidesheets, doorsheets, door collars, inside combustion chamber sheets and in fact weld other cracks on the top and under the flue sheet, with great success. We have welded cracks in the side sheet up to 18 inches long, and as time goes on our welders are improving—they are doing better work.

MR. T. P. MADDEN: We have been using oxy-acetylene welding for the past 18 months. We have done considerable patch welding in different parts of the fireboxes and have met with some failures. About all of this kind of work we do now is in the small shops. When engines go to the large shops for general repairs, instead of welding in patches, half or full plates are applied and are welded in. We get better results and have very few failures. In the past year we have welded in 100 pairs of side sheets and 43 quarter flue sheets. That is we cut off the top of the flue sheet below the belly braces and renew it. With that class of work we are having the best results. We weld in many door collars and three-quarter door sheets.

MR. BORNEMAN: Do you put in the rivets in the entire firebox before making the weld?

MR. MADDEN: The rivets are driven in the flange of door and flue sheet. All stay bolts are put into sheets. Mudring rivets are left out until all the welding has been done.

MR. HARTHILL: In closing the discussion I wish particularly to speak of one thing, concerning which I feel very much pleased. I have been coming to the conventions for a good many years. I have been a member since 1910. Some have said they never had a failure, but when the superintendents of motive power read the minutes of this discussion they will find that their men are not the only ones who have had failures. My superior will know that I am not the only one. I thank you, gentlemen, for stating facts.

In regard to welding I want to bring out a point which I came across in another test. I did not make this test myself. It was made in another shop and came to me. The experiment was made and it was found that the pressure when welding is 21,450 pounds. If you are going to get that and keep that strain in there, doesn't that contribute to failure? I want some gentleman to explain where this strain goes to if it does not stay in the weld. As to material, I think that the very best is not too good to put in the firebox. I know that is true on our division. The New York Central wants the best it can get. We want the best Swedish wire. If it is the least bit soft it is rejected. If poor material is used failures may be expected; you will have poor results, and as to welders, you must make them yourself. It is not necessary to take a boiler maker or a blacksmith and make a welder of him; that is a mistake. It is a different proposition; you expect him to go right in and be a good welder. Select a good, intelligent man and let him serve an apprenticeship; let him understand that welding is a trade by itself; then you will get good results and such a welder can give from 85 per cent. to 100 per cent. efficiency. He should get the highest pay, and if that is not done the best results will not be gained. You are to visit our shops and I will show you that we have had failures. I will show you engines that have been in service three years. I believe there is one—a switch engine—that has run four and a half years, and the weld in it is as good to-day as when it was put in. When we first installed this method the demonstrator told me how to drop the sheet, but I did not do that. I experimented and had trouble, but then I went back to the suggestion of the demonstrator and studied it out, experimenting for two and a half years. The result is we have found that up to the present time the strain on the sheet in welding is 21,450 pounds, which ought to be taken care of. I do not see how that is going to be done if you do not drop the sheet. I wish this could be explained thoroughly, because then if the point mentioned could be overcome we could get a larger outfit. That is what we are all looking for. We want to get the most we can out of these things and save money for our corporations. That is my object. I want to please my people and give them the best there is, but one must have the material, and the best men to do the work.

MR. WESTOVER: In the experiment how much did they drop the sheet?

MR. HARTHILL: It was not my experiment; I hope that the member here who made the experiment will give us his experience. I heard of it and looked into it, and I found that the report was very essential; in fact, the report showed the number of pounds strain on the sheet per foot.

MR. GALLAGHER of the B. & O.: With regard to dropping the sheet, we don't do that; we rivet the mudrings and drive them. We take care of it by corrugation.

MR. POWERS: On the Chicago & Northwestern we have about 18 welders at the present time. About four months ago we made an experiment putting in side sheets, lapping them, not butting them at all, on three different engines, one with an OG and two with wide fireboxes. Up to the present time these engines have run without any failure. We also cut the knuckle in the same way as described by Mr. Westover. We take care of both contraction and expansion in the same way mentioned by Mr. Gallagher, with corrugation. Another interesting thing that we have been doing is on engines with bad rivet seams. We cut out the rivets, cut half way through the side sheet, not the crown, and then scarf it and weld the rivet holes, weld right over the whole seam, welding on the top, calking the edge of the side sheet. We have 35 or 40 engines in service and so far have had one failure. We weld all the door holes in and weld the bottom of the front flue sheets. We weld side sheets in a good many cases. The sidesheets on the Northwestern crack at times in the bad water districts and we have been able to keep engines in service many more months by using oxy-acetylene. We think it is so important that we have installed a portable outfit in some of the roundhouses, so that if they have cracks they can be welded in the roundhouse. We have welded four or five sets of our superheaters with oxy-acetylene and up to date—we started about two years ago—they have given remarkable satisfaction. It takes considerably longer, and the copper must be left out. The flues over must not be beaded and a homogeneous sheet must be made. This has been remarkably satisfactory in bad water. Then, speaking about welding, I think a man should specify what kind of water he had. We find that bad water makes a great deal of difference in the life of a weld, and I think we should state this. Some parts of our road are in good water districts, but in the section around Sioux City, our welds don't hold up long. They do very well though in comparison with

the new sheets on the Sioux City line, which don't last either; so I don't think it should be against the welding altogether.

MR. R. W. CLARK: I don't know that I have anything new to say to the convention concerning oxy-acetylene work. I have said and written so much about it I have nothing else to add now. I don't think I can say anything more than has been said this morning about the oxy-acetylene torch. It is all right and has its place in the railroad shop. We have gone into the electric welding and I will speak on that when it comes up.

MR. A. N. LUCAS: I would like to use about two minutes of my five. We are doing about everything the same as you other gentlemen. We have an oxy-acetylene outfit and we believe in it. We believe it is a good thing and it is the coming method of taking care of many repairs. We have had the oxy-acetylene outfit for the past three years and we take care of all the welding. Since we installed it we have not taken off a tire. We have welded cracks, worn spots below the pin, as long as 30 inches without any trouble whatever. We are welding up seams and cutting off 30 inches from the front end of the crown sheet, welding on new radial and then applying. I believe this has been pretty thoroughly gone over and we have given all the members a thorough idea of what can be done. They can go home and work along these lines and get good results.

MR. KNAUER: We have had oxy-acetylene welding in our plant for about eight months and a great deal of work has been done. We have put patches on the firebox and put in two fireboxes complete. We have welded mudrings and the superintendent of motive power is very well pleased. We have about 90 per cent. efficiency. We have had a few failures but no bad ones. We have welded top flues and side sheets and any part of the firebox, and also the firebox welded in complete.

MR. KELLY: I wish to hear something more on this subject. This report has to go to superintendents of motive power and one member has stated that you must leave the sidesheet loose, dropping it so many inches because of the pressure per foot; then another man gets up and says there is nothing to it at all; that you have to put in your staybolts and put in corrugation. Now there is a big point right there, gentlemen, and it must be solved; we must come to some conclusion. There should be some right way to do this work. Either leave the sheet loose and keep the pressure off, or, if there is no pressure, put the sheet on and rivet it all up solid and weld. There is too big a difference in this and I think all members ought to state their opinions and give proof—not sit here and then go home and

have your superintendent of motive power say to you, "Why didn't you get up on the floor?" They will ask you what you are going to do about it; that is what you were sent here for. Many men are here who have had good experience and I would like to have this question threshed out.

MR. D. A. LUCAS: I can only speak from experience. In 1910 I put in the oxy-acetylene apparatus and had a demonstrator. His method was to drop the sheet as suggested by Mr. Harthill and others. I tried that experiment for quite a while and did not have success. I don't advocate putting in a sheet and riveting it to the mudring and tying it perfectly tight, but put in the sheet, put in a few ordinary bolts in the mudring, rivet the flanges, flue and door sheet and then run in the staybolts. Then we were ready to weld. I have a check on this. I have had grand results. We have had half side-sheets welded that are just as good as when they were made and I believe that Mr. Madden can bear me out in this statement. I have had them come in for new boxes that had had half side sheets welded and the weld was perfect. Now I am not able to state where the pressure goes nor how it is taken care of, but it don't seem to exist in real practice. Formerly, when a side sheet cracked six or eight inches, I have seen them sewed up for 24 inches and we did not think anything of sewing it. There was no holding power. It put a depression inside and still there was no leak. There is not the tremendous pressure they try to lead us to believe. I consider myself one of the pioneers and I thought I was when I first came to the convention, because I came here in 1910, and very enthusiastic about welding. I did not meet with much encouragement and I had pictures of everything to tell what I was doing. Now the field is opening up every day. There are new ideas and I want to be fair with everybody here. I don't think there is anything in leaving a side-sheet loose with an OG Bend in it. You might experience some trouble but not much in the straight side sheet in a wide firebox with a perfectly straight side.

MR. J. O. CRITES: The foreman of the largest shop in our division, M. I. Wharton, has had a good deal of experience with both oxy-acetylene and electric welding. He is a little bashful, but I wish he would give us his experience. About two years ago he put in two half sides; one side with oxy-acetylene and the other with the electric welding. Just a short time ago I was in the firebox and examined them. They were both fine—one was just as good as the other; as far as I know we have had no difficulty. I hope Mr. Wharton is in the audience and if he is would like him to rise.

MR. M. I. WHARTON: As far as oxy-acetylene is concerned my experience has been brief. We welded on one sidesheet with oxy-acetylene and one with electric. We dropped one-eighths of an inch and in welding the sheet it started to buckle and pull which showed that there was some strain on it; but the sheet has held and with electric welding we have welded a great deal, but that is not the subject. I don't understand about the expansion and strain on the sheet, but other members claim they have welded the whole flue sheet and drop it and that is what takes care of the strain. I believe others take care of that by putting in corrugation.

THE PRESIDENT: Gentlemen, I think we have threshed this subject out pretty thoroughly and I think we will now pass on to the next subject, "Electric Welding."

MR. PATRICK: We have heard a lot about what oxy-acetylene welding will do, but I would like to hear some of the things it won't do.

THE PRESIDENT: Well, I don't know as there is anything it won't do; in my opinion welding is the coming thing, but I really prefer the solid sheet. I am one man who prefers the solid plate, 100 per cent. strength. As President of this organization I think that some of the members are going really too far in oxy-acetylene welding. While without doubt it is the coming thing I think men are applying patches to-day in different parts of the firebox when it is really more of an expense to the railroad than if they were to put in the solid sheet, the solid plate or the full sheet. I think that in putting in sidesheets it is a good idea to weld the longitudinal seam, but in new firebox work I don't believe much is gained by welding in flue sheets and door sheets. On our railroad we don't have a flue sheet flange, or a door sheet flange welded. We scarf them down to about one-eighth of an inch at the edge of the flange, drive the rivets and countersink. We never have any trouble with the seams. I believe with our method of working we are putting in our fireboxes cheaper than if we welded them with oxy-acetylene. Of course, our shop is different from a good many others. We do it all on the piece work basis and we have not really figured actual cost; but I think when that is summed up a good many men that are doing a lot of this welding will get away from it. Without doubt the oxy-acetylene and electric welding machines are here to stay and are giving good results, and are going to give better results, but I think that the members who are not in the game very strongly should go a little slow. I don't think it pays to weld up a long crack, or weld patches right in the center of the firebox. Patches in the mudring and sidesheet can be done successfully and will hold, but patches right on the fire line, in the bad water districts, I am afraid will mean a good deal of trouble.

MR. A. N. LUCAS: I think I have two minutes coming to me. We are all boiler makers and sometimes we may not use the best judgment, but I think it is perfectly right to put on patches, especially round patches. You would not throw away a pair of trousers if they had a little hole in them; you would not throw away a coat if it needed a button; so if you use good judgment in this welding proposition, you can save money for your people. I don't believe in putting in a new side sheet if you have but a few cracks or a poor spot. I believe in welding it up; you will find that the weld will stand.

MR. WANDBERG: With regard to patches I will say that when we first started that we confined it altogether to small patches, we had no trouble with the weld provided you got on the fireline; what I mean by that is that we have patches as large as 36 by 50 and they have been in service two years and we have no failures. I tried to confine myself to 12 by 14 inch patches, but what I got up to ask is, if any of the members have had any experience in laying the patch right on and then welding? Now I have tried a couple of patches, but I have not had time enough to really try it out, but I am satisfied in my own mind that in doing that there is no strain on the sheet. I allowed about a quarter inch lap. Has anyone had any experience along that line?

MR. HEMPEL: We do not use the oxy-acetylene welder on the Union Pacific. We have had the electric welder for the past six years. I therefore thought it would be better for me to talk on electric welding, but I would like to say a word in regard to the metal. Mr. Wandberg and Mr. Lewis laid great stress on the quality of the metal. I do not think it matters much what quality of metal you use, if you even use the same as the original plate. We shipped metal to various points and one shop would say the metal was no good; that it was not the same that they had been getting, and the same metal shipped to another point would be satisfactory to the men; it would be given to an efficient welder and he would say that the metal was better than that he had been using. So I think it is more in the operator being able to properly fuse the metal.

MR. YOUNG: I witnessed a test in the welding of a half side sheet to see how far the sheet would travel. The sheet was left loose and dropped down so that the holes in the mudring were off nearly 3-16 of an inch. The welder started at each and welding a foot or more, then at the center and so on until he had finished. After the sheet had cooled off, the holes in the mudring were perfect.

MR. KNAUER: About eight months ago we had a Mallet type engine and the sidesheets cracked. Everybody knows the scarcity of material and the firebox foreman and inspector decided to weld in the entire length, 10 feet. We put in corrugation of three-quarters of an inch between the lower staybolts. We have not had any trouble with it, and a number since put in then have given us first class service. The strain is taken care of by the corrugations.

THE PRESIDENT: We will now go on to the next subject.

MR. D. A. LUCAS: Before the subject of oxy-acetylene welding is disposed of I move that the subject be extended and a committee appointed; that every foreman boiler maker hand in a report to this committee and tell them exactly what his practice is, what success he has. Let us get to a foundation and see if we can't finish it next year. It has been reported on every year since 1910. Motion seconded.

MR. STRINSKY: In writing to this committee, when you apply a patch on the flue sheet, give the difference in cost of welding with oxy-acetylene or applying a new one. I also agree with Mr. Greene that if the sheet is old or anything like that the best thing to do is to take the old sheet out.

The motion of Mr. Lucas was carried.

THE CHAIRMAN: The next subject is "Electric Welding and Its Advantage in Boiler Repairs," Mr. P. F. Gallagher, Chairman.

REPORT OF THE COMMITTEE ON
"Electric Welding and Its Advantages in Boiler Repairs."

Welding by electricity was started at Mount Clare, July, 1913, with a one man machine. After a short time we had another installed and have now on requisition one four-man machine.

Most of our electric welding has been confined to the welding of flues, because the flues are not yet far enough advanced to do much of any other work.

Since the installation of the two one-man machines at Mount Clare on each of which we have been running three eight hour shifts on each machine for some time past, we have welded flues for 754 engines—178,890 small and 12,206 superheater flues—a total of 191,096 flues. This was from July, 1913 to October, 1915.

We have welded a side sheet on yard engine No. 1103 which has been in continual service since 1913 and the sheet is as good now as when welded as far as the weld is concerned.

Some authorities claim that electric welding when done right and with the proper material is as strong as the solid plate. In some instances pieces have pulled higher in tensile strength than the solid plate.

To get good results, the machine should control the voltage so as to keep it uniform at the weld. Fluctuations in the voltage or amperes mean a difference of temperature at the arc and weld. A weld will not be uniform throughout, under such conditions.

An automatic controller should be gotten up to control the voltage at the operator's hand.

Without proper wire it is very hard to make a good weld and a great many of the cracked welds are due to using bad wire. We are now using a Swedish iron with good results.

When welding a crack the section of crack should be built up, and should be greater than the plate thickness by about ⅛ inch or ¼ inch. Layer after layer should be applied across the width and length of the crack until it is filled up. This method allows the metal to cool and prevents a great deal of contraction by removing the strain from the weld.

The fire box of one engine on our road, class E-13b, has been welded complete at Clifton Shop, Staten Island, and has been passed by the New York Public Safety Commission.

All parts to be welded must be thoroughly cleaned with a roughing tool or sand blast. The latter is preferable when it can be used, as it cleans the work properly and removes all foreign substances.

The welding of flues is very important. It is our practice to set all flues back to head prior to welding, and the boiler must be steamed before welding so as to burn all the excess oil under the bead. If this is not done the result will be that the weld will be porous, due to the oil coming out as soon as the welding of the flue begins, making an inferior weld, as oil will not allow the electrode to properly adhere to the flue.

About the proper amount of current to use to weld flues, at our shop is as follows:—60 to 65 volt direct current, 130-145 amperes, using 5/32 inch diameter wire and also a flux coated on welding wire by dampening the same and then applying flux, the work to stand until dry.

When welding flue sheets, door sheets, and door necks with electric weld all the caulking edge must be chipped, and cleaned with a roughing tool. All fire-cracks must be chipped to 45% bevel to rivet edge. The weld must begin at the bottom. It will not remain tight if welded down.

All the work must be caulked with roughing tool to close all pores in the metal after welding. All cracks must be chipped to 45% bevel to the bottom of crack to make a safe job.

Fireboxes can be successfully welded instead of riveting. Make the weld come in between the first and second rows of stay-bolts which will stiffen them. To do this the flue sheet and door sheet flanges must be deeper to allow the weld to come in between the staybolts.

All mud ring corners can be welded by lapping the weld over caulking edge. Caulk with a blunt square tool. If this is properly done it will eliminate further trouble. All shell patches can be welded along the edge and will prevent trouble from leaks.

The average time to weld a set of small flues 2¼ inch diameter is at the rate of about 20 per hour; for superheater flues about 6 per hour. It all depends on the operator and the machine. It takes about four hours to weld around the caulking edge of a flue sheet, measuring about 18 feet over all, averaging about 40 inches per hour steady welding. Steel can be successfully welded and all machine parts can be welded and machined to size. All engine frame rubs can be filled in solid. Wheel tires can be welded where worn and machined. All flat spots can be filled in, thus saving the renewal of a tire. All liners can be tacked to prevent them from working out.

Out of 21 class P-3 engines that had flues welded two years ago, only six have had flues welded.

The electric welding process can also be used on smoke box connections, especially where the smoke box and extension are in two pieces, by welding the joint half way round the circumference, thus preventing the possibility of burning and warping the plate, due to air being drawn in owing to leakage. Patches can also be welded in smoke boxes damaged in accidents. This method is safe and reliable and cheaper than riveting or acetylene welding.

Electric welding is very good to repair cast iron, such as broken gear wheels, frames of drill presses, housings of punch machines, and bulldoxers or machinery of any kind that is not subjected to heat, as the weld usually holds when the metal is kept at an even temperature.

P. F. GALLAGHER, Chairman

The Welding of Steel Plates

I am indebted to the Lincoln Electric Company for the following information on the welding of steel plates:

The problems met in the welding of steel plate are the same met with in the welding of cast steel so far as the character of the metal in the weld is concerned. In sheet metal we have, however, a product which has passed through a process which improves its qualty, beyond that of cast steel: namely, the mechanical treatment in the rolls. The result of this mechanical treatment is greater compactness of the structure with a resultant increase in toughness. Now the welded piece of sheet metal will consist of two grades of metal—the original metal which has received mechanical treatment and the metal added by the welding process which has not received mechanical treatment. The metal added by the welding process will always have, in general, the chaaracteristics of cast steel and the original unmelted plate will always have the properties of rolled metal. The metal in the weld may be hard or soft, of high or low tensile strength, but it will never have the toughness and ability to resist the tendency to crack in bending that is possessed by the rolled metal.

Up to the present time no cast steel has been produced which has all of the properties to the same degree as are found in any given piece of rolled metal. This limitation of any welding process in which steel is melted should never be lost sight of in welding practice.

As has been noted in the study of cast steel, the properties of this form of metal depend upon the kind and the amount of the several impurities which are contained in the metal. The amount

of carbon contained in the metal is the controlling impurity. From the foregoing several general conclusions may be drawn:—

First: The tensile strength of the cast steel in the weld may be made less than, greater than, or equal to the tensile strength of the metal in the original section. This holds for commercial plate only.

Second: The metal may be harder or softer than the metal in the original piece. The tensile strength of the metal in the weld will vary with the hardness. Burned metal is neglected in this conclusion.

Third: The elasticity of the metal in the weld will always be less than the elasticity of the metal in the original plate.

The character of the finished weld depends on the composition of the metals being welded and upon the skill of the operator. The mere fact that the metal is melted and allowed to run into a joint does not indicate that the metals are welded, since it is easily possible to melt the metals without welding them. A weld is made when the metals to be welded are in the liquid state with the slag and oxide floating on top. The simplest analogy is the case of welding together two pieces of pitch. While cold the pieces will not even adhere. Brought to the liquid state the two pieces merge one into the other and at the region of contact entirely lose their identity. Upon cooling the joint is perfect. Now, coat the pieces of pitch with paint (which corresponds to the oxide on hot steel) and try to weld them together. Until the two pieces are perfectly liquid and the paint is floated on the joint, a perfect weld is impossible.

Flaws and imperfect welds in steel are due to the fact that the metals being welded were not properly liquified and the presence of the oxide or slag—or both—prevent a perfect union.

It is a notable fact, however, that in autogenous welding (so called because of its self or auto generation the actual union is made in plain view of the operator, so that if it is not perfect, he knows it. Knowing the tensile strength of the plate and of the metal added the skillful and conscientious operator can predict accurately the behavior of a given welded piece under a pulling test.

The application of electric welding to sheet metal (1 1-16 inches to 1½ inches in thickness), has up to the present time been used principally as a substitute for riveting, owing to the fact that the work can be done in most cases at from 5% to 50% of the cost. If the welded piece stood the service demanded of it as well as the riveted piece, the extra profit accruing was pocketed and nothing more done. If the welded joint failed the process was condemned in no uncertain terms and its use discontinued. This plan is a poor one since the results may be accurately predetermined before the job is attempted.

The few failures of the process have been due, perhaps, to the fact that it is easy to make an arc welded joint which will appear to have the same tensile strength as a riveted joint. The single riveted lap joint is 55% efficient under the most favorable conditions while the quadruple riveted double strap-joint may have an efficiency as high as 85%. A skillful electric arc welder will make a joint which has an efficiency of 90% without particular effort. Stiffness equivalent to that of the riveted joint may be pro-

duced by making the section of the joint greater than that of the unwelded section.

An intellegent analysis of the problems encountered in the service required of a given joint together with an application of established welding methods will leave no excuse for the failure of a joint which has been calculated to hold. The intelligent welder does not guess—he knows what the joint will do.

The failures of the past have been due to ignorance and the haphazard application; not to the fact that the results obtained by the use of the arc welding process are uncertain. Practically all sheet metal welding where metal is added is done by the metal electrode process, although the carbon electrode may be used on plates over ½ inch in thickness in certain application. At the present time two kinds of electrode are in general use on sheet metal work—Norway or Swedish iron (or American equivalent) and low carbon steel wire. The iron wire gives metal in the weld of a tensile strength of approximately 40,000 pounds per square inch while the steel of 10% carbon content may be relied upon to produce metal in the weld of a tensile strength above 50,000 pounds per square inch.

On plates of ⅛ inch thickness and less an electrode of 1/16 to 3/32 inches in diameter represents the best practice. A current density in the circuit of not to exceed 75 amperes should be used on this small electrode. Plates between ⅛ inch and 5/16 inch are usually welded with electrode ⅛ inch or 5/32 inches in diameter with a current density in the circuit of not more than 120 amperes. Plates thicker than 5/16 inch are usually welded with ¼ inch electrode using a current density of approximately 170 amperes. An iron electrode may be melted more rapidly than one of steel and has less tendency to burn than the steel. In general, however, it is more difficult to weld with an iron electrode than with one of steel. To get the best results, that is, the best weld possible with any electrode, the current density in the circuit should be kept as low as is consistent with a usable arc.

Practically no applications of the electric arc process have been made on plates having a thickness of less than 1/16 inch where a butt joint is required. This is due to the great intensity of the heat with the consequent tendency to "burn through" where the edges of the plate are in small parallel planes. However, they may be melted together with a low current carbon arc with excellent results.

P. F. GALLAGHER.

MR. D. A. LUCAS: I move that the report be accepted and the subject opened for discussion. Carried.

THE PRESIDENT: The subject is now open for discussion and I will call on the gentlemen who are using the electric welder to give their views and ideas. Many good boiler makers are here and I know they could give us a lot of valuable information, if they would get up; that is what your railroad sent you here for, not only to sit and listen, but to also give your experience. I don't think it is right for just a few of the members to do all the talking and all the work,

so I expect every gentleman to get up and be sure that what you say is absolutely a fact. I don't believe in making anything broader than it really is. Whatever you are doing, tell us the facts and be sure it is absolutely right.

MR. NEWGIRG: About five months ago we had two bad sidesheets. We removed the rivets, beveled down the sheet, cut off the flange, removed the staybolts and V-d out the bad cracks; we electric welded it and it is giving us good service.

MR. HEMPEL: As I stated before, we have a number of electric welding machines. We run from 200 amphere to 1500 amphere machines. The quality of work being done at our shop is excellent. We do as much machine work as boiler work; in fact, we have more lines doing work for other repairs than for boiler work, such as welding driving centers. I have seen wheels with nearly all of the spokes broken, cast steel wheels, and they were welded back in the driving center, the electric welder being run in filled with metal, and the wheels would be welded up fine. We do all classes of work, anything —trailers, frames, etc. I don't agree with the President, that we are going too far either in the electric or oxy-acetylene welding. We simply replace the worn parts. We are going to get away from rivets; that is something that is coming. I took a little trip south last winter and I stopped at the shops at Waycross, Ga., the first I believe that put in inside sheets. They were not removing the mudring or any other rivets. If the fire cracks appear in the door sheet or flue sheet seams, they cut them out, but in applying side sheets they are cutting above the mudring. I went home, and for the past five months we have not cut out a mudring rivet, and we have not had a failure. We have not had many failures with the electric welding. We have not had one failure in the welding of frames. So I am not going to go back on the electric welding or the oxy-acetylene propositions. The reason we use the electric welding is because we think it is cheaper, and it is the best, but in an up-to-date shop you should have both kinds.

We are figuring on a new plant now, but not altogether for boiler work, mostly for lighter work, car work, for which I think the oxy-acetylene is better. I do not think there is anything you can do with the oxy-acetylene welding that you cannot do with the electric. Mr. Pratt spoke of the electric welding of flues. He possibly would like to have the members say something about that. In the various districts west of Cheyenne they weld around the flues of the engine as it comes into the shop; that is, in a good water district; but in the bad water districts we weld just about as few as we can. We have very poor success in bad water districts. However, we do prolong the life of the flue from about six to eight months; probably get from 10 to 12 months service out of them before weld-

ing. That is what you want to do; keep your engine in service; you want to get further mileage out of it.

I was very much interested in a statement made by a gentleman when I was coming down on the train. He said he welded in his flues with the water in the boiler. I thought of that and I am going to try it when I go home. I believe it is the right thing to do. In the electric welding of flues, the flues get loose at the end, to some extent in the hole, and I am inclined to think that by welding the flues with the water in the boiler, it has a tendency to keep it cool and keep the flues from contracting. The flues after being welded should be re-rolled without water in the boiler, or very little—just sufficient to take up the slack that has been caused by the electric welding.

So far as the expansion is concerned there was considerable discussion on that when we took up the subject of oxy-acetylene welding. When we first started the electric welding we dropped the sheets about an inch and seven-eighths, starting at one end and welding up; after visiting quite a number of shops doing this class of work and looking into it very thoroughly, I became convinced there was nothing in it; so I went back and I had the plates put in without dropping them below the mudring.

There is one case I want to cite. I went to Denver and found the sidesheet sticking below the mudring. I saw they were having some trouble; they looked as though they wanted to cover up something; the welder said that the general foreman had taken him off of the job before he had finished. I told them to cut out the side plates and told the foreman I was surprised that he took that man off the job when it was only partly welded. The plate had become fixed and no matter what pressure you used, you could not have moved it, and it was necessary to remove the plate, because it had been taken up in proportion as the welding was being done. So if you weld your plate and drop it, you must continue; don't stop the operation until the job is finished; but if you put in the plate, put in all the bolts and tack your plate, when you weld up to it, pound the metal gradually as you go along, very slightly, sufficient to take up the expansion. Mr. Lucas said he did not believe there was any pressure on the plate; if there was not pressure, if the plates did not contract and expand, if they did not buckle up this way, what is the cause of cracks? When the plates are cold there is a stress on them and all you need to do is to take your hammer, tap it lightly and take that out. I think you should pound your metal and then let your plates go into service and they will be about the same as the original.

MR. POWERS: You said that some shops drop their sheet one and seven-eighths. Was that electric?

MR. HEMPEL: Yes. I was speaking of electric welding altogether. We are not doing the oxy-acetylene. I have been telling you what we have been doing with electric welding. I might say that in electric welding of flues we are apparently going up against something we are not looking for. We find cracking of the flues lengthwise. I was down in Green River a few weeks ago and I find that has been the cause of flue failure. We have been electric welding flues for only a year or a year and a half, but we have been using the electric welding for six years and have had very good success. I may say that we do not have many failures. If the original plate will crack, the electric welding or the acetylene welding will crack in time. You must remember that you are only making repairs to prolong the life of your box. The electric welding will crack in time, or some part adjacent to it, just the same as the original plate cracked.

MR. D. A. LUCAS: As I understand it you used to drop your plate, but you have discontinued it; you do not drop it any more.

MR. HEMPEL: No, we do not drop it now; it is not necessary.

MR. POWERS: In dropping your plate an inch and seven-eighths you drop that on one end, and when you got across to the other, had the plate gone up the inch and seven-eighths.

MR. HEMPEL: The inch and seven-eighths went up entirely. The operator was very careful to get the plate exactly right. He was very careful not to pound the metal much, for if he did the plate would not come up; so that is what led us to believe that we could take care of the expansion by not dropping the plate, but by pounding the metal. You have to watch those things; that is the point that led us to believe it was not necessary to drop the plate.

MR. GRAY: We have had the electric welder on our road about three years. We weld in all our half side sheets, half door sheets and patches with the electric welder. We have done practically no welding on boilers with the oxy-acetylene process. In applying half side sheets we cut down the flanges of flue sheet and door sheet, and cut across the top, as many rows of stay bolts high as is necessary to remove all defects in the sheet. We then fit in the new sheet, leaving not less than three-sixteenths of an inch opening between the sheets at the bottom of the two bevels. We frequently get a greater opening than three-sixteenths of an inch but never leave less, so that the welder will be sure to get the weld clear through and make a good solid job. We bolt the sheets at the mudring, but do not drive the mudring rivets until after the welding is done, or at least all that is parallel with the mudring. The vertical welds at the front and back corners may be welded after the mudring rivets are driven,

but as a general proposition we aim to complete the welding before we drive any of the rivets. We have found that it does not make a great deal of difference where you begin to weld, or where you finish up. With the exception that in welding in half door sheets, we make the last weld around the door hole. As to patches, we first tried the square or rectangle shaped patch, but in flush with the old sheet. Our success with this style was poor. We then tried the offset or O-GU patch, which was all right for a time. The vertical welds would crack soon after re-welding the patch cracked in the O-GU. While we had no trouble to speak of with the tap or end welds of half sidesheets, we experienced considerable with the vertical welds in patches. About six or seven months ago we began cutting our patches out in irregular curves (except at the top), so that there would not be a vertical weld at any point. These patches are put in perfectly flat and flush with the old sheet. When the weld is chipped off and bobbed down the patch can hardly be detected. So far these patches have run very successfully. Not a single weld in one of them has cracked. In all of our firebox welding we chip off the rought part of the welds and then bob the weld down flush with the sheet. This not only closes any pin holes that may be in the weld, but gives the weld a very good test, because if there is undue strain anywhere in the weld, it will develop under the bobbing process. We weld all of our superheater flues at the back end with the electric welder, and have never had an engine failure from superheater flues leaking since we have been doing so.

MR. YOUNG: Is Mr. Mansfield of the Jersey Central in the room. I don't believe there is a road in the country that has gone into the electric welding as extensively as this one. They weld every conceivable job that comes to the boiler shop and if Mr. Mansfield is here he can give us some valuable information.

MR. C. A. NICHOLSON: About two years ago we put in an electric welding machine at the Atlanta shops of the Southern Railroad and we have been working with good success.

Of course all men when they get an electric welding machine have more or less trouble and we did, too. It takes experience to learn. We began with the electric welding of flues. We had a demonstrator only a short time. He left us to pick it up for ourselves the best we could. In the first 12 months we welded about 35,000 flues, about 25 or 30 side-sheets, and large patches. We found at first that in welding butt patches the strain was so great on the sheet that after we finished, especially about the last side in the work mentioned, the sheet would crack. With one engine we had considerable trouble. In regard to patches and side-sheets, we have changed our method and lap-weld with sheet lapping a half inch. In doing this we can take a half side sheet, or a full side, or any kind of a sheet, put in the stay bolts, and if the welder is busy,

we go ahead and rivet the mudring and let the welder come when he gets the time. Sometimes we get the stay bolts and mudring riveted before he arrives, and again we weld the sheet before the other work is done. We have never had one failure, not one, and we have them in all shapes. We take a door sheet, one-half or three-quarter door sheet and put it in without a rivet with the exception of the mudring. We weld them all in the same way. In the door hole we have the usual lap—that is in the sheet when riveted, and we have all the success that can be gained. We have never had one failure on that. As to cracks we have had many failures. We V-'d them out and welded, but they would come back cracked. So we welded them over again, and probably 50 per cent. or 60 per cent. held. Some of them have been failures. We have welded cracks as long as 50 inches on the side sheet. One is still in service and has been for more than a year. We have considerable trouble with our flue sheet flanges cracking on the top knuckle and I think we have probably 35 flue sheet flanges in which we V'd out the crack and welded. One of these broke, so that gives a very good percentage. We can weld them very much cheaper than patching besides having the engine in service sooner.

Another thing that we have found out, which I think would be a great help to a number of you people, and that is the small cracks can be welded successfully without V-ing out the crack. Instead we fill the boiler full of water, caulk the crack the usual way, as far as it extends and reinforce the sheet with three-eighths of an inch thickness of metal an inch wide over the crack. In this way we have eliminated the V-ing out of the crack and removal of the staybolts. We have done a great deal of other work with the welder, but I believe what I have described may be of some benefit to the members.

MR. POWERS: I would like to ask a question, Mr. Nicholson, do you have full thickness and bevel it down, how do you complete that operation?

MR. NICHOLSON: Full thickness and then bevel it down to the ordinary before the sheet is welded.

MR. POWERS: What kind of success do you have in building the crack up without cutting out, don't you find that the weld gets hot in service, I mean after it is in service?

MR. NICHOLSON: We have not had a failure as yet, we expect failures on this proposition on account of the sheet conditions, but as far as the immediate cracks are concerned, we have not found any as yet.

MR. C. R. BENNETT: Is there a member present who is able to explain how a defect on the electric weld can be detected before the engine goes into service.

MR. GRAY: I might be able to partially answer that question. We use the air hammer to bob down the weld and that is a pretty good test of the weld. Whether the weld is going to hold can be determined, because if there is an undue strain it will crack. That is the only test we have.

MR. BENNETT: Can anybody using the oxy-acetylene gas answer that question?

MR. C. N. NAU: About four years ago we began welding side sheets door sheets and patches, as well as the inside sheet. We did not have very good success with the square patches. So we tried a round one to take up the bad spots of the side sheets and now we are having excellent results. We are still welding the mudring and the door collar. On our division we have about 40 engines with the collars welded up that give no trouble. Of course, we don't know how much life we really could get out of the welding because, when the engine comes into the shop, the sheets are removed and the welding done when new sheets are applied. We have some sheets that have been running about two and a half years, and are still giving good service.

MR. HURSH: I have had a few years of experience with electric welding, and weld about everything that comes into the shop with the electirc welder. We weld side sheets, and half sidesheets, sheets in fireboxes, cracks and patches on side sheet, and patch the top and bottom of flue sheets—that is, cut out a number of flue holes and apply patches. We weld mudring corners, washout holes and crown bolt holes. We take the crown bolts out and weld all the holes solid, drill new holes, tap them out, and apply a new set of crown bolts. On side sheets and half sidesheets, we lap the sheet down the flanges and cut the rivet holes off the flange back of the holes; we then bevel the flange and weld the flange to the sidesheets which does away with the rivets in the flange. We have cracks 45 inches long that were welded and are giving very good service. We have tried "V" shaped and oval shaped patches, but have had some trouble with them. When we have patches with vertical welding we put a small offset in it, weld one side up, and the offset takes care of the second vertical weld, and they are giving very good satisfaction.

We have 41,000 two-inch flues welded in the back flue sheet, and they are giving good satisfaction. We have a number of engines, the flues of which have been in service three years. We have some engines with the superheater tubes that were welded in about four years. We have pretty good water in our district. I have found a number of two-inch flues in the last few months cracked lengthwise, from the bead inward, and I think the reason is that they were rewelded flues—welded the second time—making a bead entirely too heavy. When we first began welding flues, we put a small coil around the edge of the bead that did not prove a success, as it cracked around the bead at the edge of the weld, and

now we cover the bead entirely over with very good results, although I think the weld is still a little too heavy.

In regard to side sheets, we have had them in service for quite a while, and they have never given any trouble. We have engines with 36-inch combustion chambers with full side sheets welded in. We cut the flue holes out of the front flue sheet, and put in a sheet with the superheater flue holes, without removing any of the rivets in the flange. This engine has been in service about two months. In putting in sheets we do not wait for the welding. If we have a welder to put on it all right, but as a rule we rivet up the mudring and then do the welding. In some cases we have put in the staybolts, but I would prefer leaving the staybolts out until the welding is done. We leave an opening of about three-sixteenths of an inch. Of course, it is greater than that in some places, but should be as near as you can possibly get it, and you will get good results.

THE CHAIRMAN: Do you tack your side sheets?

MR. HURSH: Yes, and well right along from one end. We have very good results without electric welding. I have nothing to say about what can be done with oxy-acetylene, as we have done very little welding with it. I prefer the electric welding machine.

MR. MADDEN: I would like to hear something from Mr. Tate on this subject.

MR. TATE: We have used electric welding with very excellent results. We have practically 3,000 locomotives with welded flues and our troubles have been practically eliminated. Other than that I do not know. Flue failures are a thing of the past, but in regard to the welding of a great many other things we have had failures. I have failed to find a crack in a firebox welded with the electric process that has not cracked. We have one case in particular where a man was welding a crack, and when he came back after dinner he found there was a larger one than when he started, so we did not pursue the case further, but took the sheet out. The question in my mind about the roads who are using all these modern appliances is "what dividends do they declare?" Some boiler makers will say that they are using oxy-acetylene and others electricity, and all of the modern appliances that they can get. Now we are in duty bound to our employers to see that they realize a dividend on money invested; that the things we recommend will pay them. If either oxy-acetylene or electric welding does not do it, throw them away and go back to the old practice; do good, safe work that will keep the locomotive in service and give the people who have their money invested a dividend. Don't blame all your troubles on the other fellow. We, as

boiler makers, are responsible for some of them and we should get on the job.

MR. AUSTIN: I wanted to hear all I could about flue welding, especially welding them in the back flue sheet, which seems to be one of the important features of this discussion. It is certain that there will always be competition between the electric and oxy-acetylene processes, and good work is done by both. The matter of applying patches and plates or side sheet welding and welding in of fireboxes has been pretty generally discussed and I assume it is pretty well understood by all. As to our troubles with flues welded in back flue sheet, we found in some districts that the coal conditions, that is the quality of fuel we use, had quite as much influence as the water conditions or the feed water we use. Some fuel has a very strong tendency to deposit what we call honeycomb or clinker and electric welded flues or any system of flue setting that carries with it big beads or excessive metal at the bead seems to attract this honey-comb which results usually in poor performance. We have some divisions where we get a great deal of this deposit on our flues and flue sheets, sometimes as thick as 1½ inches and it spreads over the whole upper portion of the sheet. The electrically welded flues in the back sheet in that territory have not given good service. We attribute this mostly to poor water and coal conditions. It has caused the large beads which are due to the weld becoming very hot and attracting this honey-combing substance, which, after being formed interferes with the locomotive steaming. No doubt the experience of Mr. Pratt and others here is that we weld up a job and it does not do well and we can do the same kind of a job on another locomotive and put it in another territory and it is a good job; so that it largely depends on the service that the locomotive is to be operated under and it is not altogether the question as to whether one job was done quite as well as another. Mr. Tate has stated that the Pennsylvania had 3,000 sets of flues welded in to the back flue sheet and I would like to know what they do to repair those flues when they start to leak. I think that should be brought out. So far in our experience we have not found a way to successfully repair them.

MR. PRATT: Mr. Austin, do you regularly expand your flues in bad water districts or otherwise?

MR. AUSTIN: When our flues are set in in the regular way that is not necessary.

MR. PRATT: I mean do you expand them periodically, once a month or every two months?

MR. AUSTIN: No, only when they show leakage.

MR. CARROLL: I would like to ask several questions on electric welding, more as a matter of information than anything else. I generally hear it said that electric welding is not good in bad water districts and will not do on flues in bad water districts. In my practice I have found that electric welding, if properly done, has been very successful in all water districts.

THE PRESIDENT: What is your method of welding your flues?

MR. CARROLL: As a general practice, we get the dirt well off the sheet and I think that is 50 per cent. of the welding.

THE PRESIDENT: Do you bead the flues in the ordinary way?

MR. CARROLL: We do and apply them.

A MEMBER: Do you use copper ferrules?

MR. CARROLL: Yes, we use copper and you will find that another failure in your electric welding where it is giving trouble is due to high voltage, which causes the metal to burn while welding. This is a point that all men should watch very closely; I find that some shops use fifty volts and others ninety, in cases like this you will have trouble.

THE PRESIDENT: What voltage do you use?

MR. CARROLL: Between 60 and 70 volts is a good average at the main panel, 90 amperes for welding flues, and 110 amperes for welding boiler steel, but the ampere depends upon the size of wire used. We weld one-half door sheets, one-half front flue sheets, side and crown sheets and studs on boilers—that is, any kind of a stud without drilling a hole. Many other things along with the electric welding make for success or failure; that is, equipment in many cases—the wire that is used to carry the voltage and amperes—is too small and they expect to get the same results. We have a 10 point machine. We located it wrong at first, but we changed the machine later to a location more central for our work and it has given good results. Some members claim that they leave the water in the boiler while welding flues, others say we should not. We have tried both methods and I do not see any difference. I would like to hear from other members.

MR. HURSH: We fire all the boilers before we weld the flues, and in fact we leave some of the engines in service for some time before the flues are welded, but we never weld the flues without firing up to burn out the oil.

THE PRESIDENT: Do you weld with water in or out of the boiler?

MR. HURSH: We have one engine that was welded with the water in which is giving good satisfaction and I think it is all right.

MR. C. R. BENNETT: I have heard only about one-half of what has been said. What I want to know is, that after the flues are welded and the locomotive is in service for a certain length of time, and the flues become weak, what is the proper thing to do then?

MR. HURSH: We use a flat prosser.

MR. BENNETT: Do you mean to clean it?

MR. HURSH: Yes, we put in the prosser and do that.

MR. BENNETT: Not weld at all?

MR. POWERS: I believe that two years ago I was one of the most enthusiastic men in attendance at the convention about the electric welding of flues. I am very glad Mr. Pratt is here, because I am in pretty bad. He told me that other railroads had been very successful in welding their flues and I am glad to hear some of the men here to-day say they have had failures in bad water districts. We have flues in good water districts that have been in service four and five years, and in bad water districts we cannot get more than three months out of them. They will honeycomb, the mud accumulates, and we put in the expander as we have been told to do this morning, but it breaks the one next to them and the only method of repairing flues when they break is to cut the weld and bead the flues over and let it go until you can get it back to a welder. I would like to hear some of the men give their experience about the welding of flues in bad water. I think it would not only be interesting to me, but to other gentlemen who are attending the convention. I particularly want this explained because of Mr. Pratt's presence so he can see I am not the only one who is having trouble with welded flues in bad water districts.

MR. RAPS of the Illinois Central: During discussions of this nature, I believe the members should be more explicit in their explanation regarding the method of performing the work and more particularly as to the information furnished with reference to the results obtained. On the Illinois Central we are not equipped with the electrical outfits for welding in locomotive boiler tubes. However, we arranged with the locomotive works to have the five and three-eighths inch superheater flues welded in some Mikado type locomotives which they were constructing. After these engines had been in service from six to seven months, it was neces-

sary to rework the flues on account of leakage. On the same class of engines in which the flues had not been welded, we obtained from 12 to 18 months' service before it was necessary to rework the superheater tubes and these engines remained in service from 45 to 51 months before it was necessary to renew any of the superheater tubes. I would like to have some additional information in regard to the welding of flues with water in the boiler. Some of the gentlemen claim that they weld with water in the boiler, while others do not, but they have neglected to advise us as to the temperature of the water—whether it is cold, or heated previous to the welding operation.

MR. TATE: On the Pennsylvania Railroad we have the standard practice, the practice that is standard all over the country, for putting in tubes. We drill the hole the actual size of the outside of the tube, put in the copper 75 thick, put in the tube, open it up and use the standard process. We bead the tube, fill the boiler full of water and weld it; that is all there is to it.

MR. RAPS: Is the water hot or cold?

MR. TATE: That is immaterial.

MR. GALLAGHER: Mr. Tate said something about using these improved things on the different railroads, about their meaning dollars and cents to the company which we represent. Mr. Hursh brought up the subject of welding the front flue sheets with the electric welder. About a month ago we took out a saturated end and welded in the superheater, and I can give you many figures that we obtained in doing this work. We have put in service in the past six weeks three fireboxes that were electrically welded. One required 30 man hours to put in, and another took 35 man hours.

MR. NAU: Mr. Tate, do you have bad water, and find more trouble with the flues in bad water than in good water.

MR. TATE: Yes, we find some trouble in bad water districts, but nothing to compare with what it was previous to welding the flues. Our principal trouble is in districts where the water has a sediment which accumulates between the tubes and cause them to burn and crack.

MR. AUSTIN: How has your success with these welded flues been obtained, especially in bad water districts and districts where you change from good to bad water? It is really astonishing to hear people say that they have 3,000 sets of flues welded and are not having very much trouble, in fact scarcely any. In some cases we have had to take them out and cut off the weld in less than a month. Now either our conditions are very

bad or we have poor workmen, I don't know which. The point I want to bring out is, that I hear that on locomotives you knock the fire every 14 days.

MR. TATE: Yes, that is correct.

MR. AUSTIN: We have to knock it about every 14 miles. (Laughter.)

MR. C. R. BENNETT: I am a representative from the Pennsylvania railroad, and I wish to say that we have had considerable trouble with the electrically welded flues. There was a time when they leaked and gave just as much trouble as the unwelded flues. I am from a division where these locomotives pull the trains which are better known as "drags" and it is, therefore, necessary to work them with all their power.

MR. WINTERSTEIN: One of the troubles that I have seen with leaky welded flues on these railroads is that they have not the tools and facilities at outlying points and engine houses to take care of these flues. I know of one railroad that gave an order for 70 engines to the Baldwin Locomotive works which were delivered last September and October. They were superheated and had both small and superheated tubes welded. The tubes had to be removed in good water districts in from four to five months. Previously they were getting 12 and 18 months' service without welding. I could not understand why the welds did not hold and investigated the matter. The reason I can advance is, a lack of proper tools to follow up slight leaks when they first developed in the weld. I went to one round house and while walking through heard a man working in the firebox on the flues; I looked into the firebox and saw him work; that it, standing up with a torch and a hand hammer pounding the beads of the flues up against the flue sheet. He had no other tools and was simply flattening the beads up against the sheet with heavy blows of the hammer. When asked if that was their method of calking flues, he replied "These are welded flues and these are the only tools we have around here with which to do this kind of work." That is one of the causes of trouble with welded flues. They are welded in the main shop and send out to round house and different engine houses where they have no welders to follow up this work.

MR. GRAY: Did these superheaters have copper ferrules?

MR. WINTERSTEIN: Yes.

MR. POWERS: If it was a good weld it ought not to have leaked.

MR. PRATT: A few of our friends here claim they have no trouble whatever in bad water districts with welded flues; that all they do is to

solder the beads so that when they weld their flues in, after finishing the beading process, they rather puddle the outer portion of the bead down into the sheet and make such a thorough weld between bead and flue sheet that they stretch the flue exactly the same as if it was not welded. Then they put the prosser in every 30 days, hammer them smooth and knock the scale loose. If that be true, it seems to me there ought to be men doing it who will stand up and say so.

MR. STEWART: The question has been asked, "What good does it do to weld flues in bad water districts?" We have been welding flues for the past 18 months, and we find in Florida, our bad water district, that by welding the flues we have eliminated round house work to a certain extent. At some points the night boilermaker has been pulled off. Also, the welded flues will keep down engine failures, caused by leaky flues. I don't believe that in bad water districts we will get much better results or more mileage out of a welded flue than one that is not welded. We have about 47,000 two-inch flues welded. We have good success with welding superheater tubes. We have welded flues in various ways and have about 25 engines with flues welded without the copper ferrules, but we did not bead the flues, only put a fillet of metal around the flue. These flues have been in service about 10 months and I find they are beginning to crack from the end of the flue back into the sheet. We now have a test under way. About four months ago I applied a new back tube sheet, drilled the flue holes one and seven-eighths of an inch and swedged the flues, applying them without the ferrules, but did not bead the flue—only welded a fillet of metal around the flue. We hope to get results from this test, as we want to get away from copper ferrules on welded flues. We find that we get good results in good water districts from welded flues. We also have trouble with the sheet honeycombing, due to dampness from the porous welds around the flue. The flue clogs and with the honeycomb on the sheet it caused the engines to fall down for the want of steam. I would like to ask some of the members if they have experienced this trouble and what is being done to overcome it.

MR. GRAY: With regard to leaking of flues electrically welded, we have one set of small flues welded in, but all of our superheater flues are welded, and we have not had a single failure or leakage of a superheater flue. We use coppers, an eighth of an inch, No. 70 ton copper, and we expand the flues and turn them over and bead them, then use the roughing tool and run around the beads, and then put about two layers of metal around the flue on the superheater flues. I can't say much about the small ones as we have only one set welded in.

MR. C. R. BENNETT: If any member here will state that after having welded the flues in the sheet and the flue leaked they chipped the old metal from the flue and sheet and then prossered or reworked the flue

without distorting the next flue hole, his statement should not be published or printed for it would be impossible to do anything of the kind.

MR. GARLAND: We had a Mikado engine that came from the Baldwin Locomotive Works. We welded the flues after the engine had been in service three years. We have rewelded them and we expect the engine to run three years longer.

MR. HEMPEL: This is one of the most important subjects we have on the program. We should adjourn now and take this up again after lunch. We could easily spend another couple of hours on it this afternoon.

MR. A. N. LUCAS: I move the discussion be closed and the subject be continued for another year. Carried.

MR. LAUGHRIDGE: I wish to call your attention to a representative of one of our largest railroads—one of the largest in the country—a gentleman who holds a high official position and who not only has always encouraged his men to come to our convention, but has also attended himself. He has always given us wise counsel and this morning he was right here on the floor with the rest of us. I know of no one who enjoys the work of this Association more and encourages us more in our work than this gentleman. I refer to Mr. Pratt, Superintendent of Motive Power of the Chicago & Northwestern. I therefore move you, Mr. President, that we make him an honorary member of this Association.

THE PRESIDENT: If I am not mistaken he is already an honorary member of this Association.

MR. LAUGHRIDGE: There may have been an error somewhere because I fail to find it in the proceedings of last year.

The motion was seconded and carried.

MR. PRATT: Gentlemen, I think this is indeed an honor. I appreciate it very much and thank you. (Applause.)

THE SECRETARY: We have received a message from Mr. Frank W. Bering, manager of the Sherman Hotel, Chicago, in which he says:

"Hotel Sherman sends its very best wishes to members of the Master Boiler Makers' Association. Hope you have a very successful meeting."

Our stalwart Vice-President, Mr. Charles P. Patrick, has lost his badge. No doubt Mr. Patrick feels worse about this than most any other member would. Probably before the convention adjourns we can provide a new badge for any of the other members who lose their badges, but we have no others bearing the words "Vice-President." Anyone

finding Mr. Patrick's convention badge or who hears of it being found, is urged to be good enough to ease the mind of our esteemed friend, Mr. Patrick.

MR. LAUGHRIDGE: Yesterday morning we received a letter from Mrs. B. F. Sarver, saying that Mr. Sarver is laid up with inflammatory rheumatism and that is why he is unable to be here. The Executive Board sent a message of sympathy and regret.

MR. PRATT: Gentlemen, I hope I won't overdo the courtesy you have extended to me. As President of the Master Mechanics' Association, I extent to this Association a request, or an invitation, to participate in our convention in Atlantic City. We believe that our Association can be benefitted very much by members of this Association taking part in the discussion on the floor; subjects to come up may be of special interest to you. You have had training and experience that has prepared you to give practical advance. Therefore, as President of the Master Mechanics' Association, I extend to you a cordial invitation, and we will be glad to have you send a representative member there. I am sure he will be accorded the privilege of the floor. (Applause.)

MR. LAUGHRIDGE: I move that we extend the thanks of this Association to Mr. Pratt's invitation and that the convention take action later. Carried.

A MEMBER: I move that at this time the Retiring President be the delegate to the Master Mechanics' convention.

(Mr. D. A. LUCAS in the Chair.)

VICE-PRESIDENT LUCAS: You have heard the motion that the Retiring President be our delegate to the convention of the Master Mechanics' Association.

MR. HEMPEL: The motion was carried that we take action on this later and I think the present motion is out of order.

The motion was put and carried, whereupon the session adjourned for the day.

THIRD DAY

MORNING SESSION.

THE PRESIDENT: The convention will please come to order. It certainly is a pleasure to me this morning to introduce Mr. J. T. Carroll, Assistant General Superintendent of Motive Power of the B. & O. Railroad, who will now address you.

ADDRESS OF MR. J. T. CARROLL.

Mr. President and Members of the Master Boiler Makers' Association:

I consider it a very great honor and pleasure, indeed, to have the privilege of addressing this important body of men assembled here in convention for the purpose of discussing the art of boiler construction and maintenance. This discussion will undoubtedly result in developing improved ways and means whereby greater knowledge as to the safe and efficient construction and maintenance of our high pressure, heavy duty, steam boilers of today will be spread broadcast to thousands of others who are responsible for the safe maintenance and operation of this most important part in the make-up of the almost unlimited number of stationary and mobile power plants of the country.

In reading over the papers of the various subjects being discussed and to be discussed at this convention, it is gratifying, indeed, to note the able manner in which they have been prepared, and it indicates that a great deal of interest and care has been taken by the members of this Association in the preparation of same, and the information contained therein will be of considerable value not only to those engaged in the performance of boiler work, but also to those who must stand the expense of the maintenance charges.

The locomotive boiler under the service conditions of to-day is the container of an amount of energy, the magnitude of which few stop to realize. It is impossible to overestimate the importance of keeping this construction in proper condition to withstand the chance under any ordinary circumstances that this energy may be released through the failure of any part.

If weak design, improper workmanship, poor maintenance, defective appurtenances or careless operation allows this energy to be suddenly released, it may cause the loss of life and the wholesale destruction of property. It is particularly important that all of us who are connected in any capacity with the construction and maintenance of boilers should constantly keep in mind that we have a very great responsibility resting upon us in imparting to all others over whom we have jurisdiction, or with whom we come in contact in our work, the great importance of following out the rules laid down by those who are vested with the authority to prepare and issue such rules and regulations.

This can be accomplished in numerous ways and it would be difficult to lay down a set of rules for this purpose. However, there is one question that has been impressed upon me a number of times, and that is, "Why is inferior work turned out of shops?" The results of the investigation of a number of cases of this kind would indicate that on the part of workmen, and in a number of instances on the part of men in supervising capacities, there has been indifference or lack of appreciation of the importance of doing the work in the best possible workmanlike manner

and a failure to fully appreciate the disastrous results that may come from not doing it properly. It is, therefore, the duty of us all to continually impress upon those actually engaged in the performance of this work the importance of doing it in the best possible manner, thereby guaranteeing safety to themselves, their fellow workmen and the public, as well as doing credit to themselves. You are the men upon whom a great deal of dependence is put to see that the boilers are maintained in such condition that they meet the Federal and other requirements in every detail and thereby make them safe to life and property beyond all doubt, this being the earnest desire of the Managing Officials of our Railroad Systems.

It may be possible that the workmen are not sufficiently instructed in regard to their work or that the instructions which are issued to them from time to time are insufficient or not entirely clear, and that the men are not checked up to be reasonably sure that the instructions are fully understood. If the instructions are insufficient or not clearly expressed, the matter should be taken up and such revisions made as will make them perfectly clear. It should be ascertained by all concerned that the men are fully equipped, both as to experience and instructions, to properly perform the important duties entrusted to them.

It may be that the method now employed by some of the railroads of issuing instructions, etc., to the workmen in their shops is not in many cases the most approved manner in which this information can be put before the workmen, while other roads may have this matter very well in hand. May it not be possible, therefore, for this Association, through its members, due to their thorough knowledge of the Federal and other requirements, to look into this subject thoroughly and see what is being done along this line by all of the railroads, and from the results of their investigation it may be possible to formulate some uniform and simple instructions to be put in the hands of the workmen of any of the railroads who may desire to do so.

THE PRESIDENT: Mr. Edward W. Young, a member of the Executive Board, will respond to the address of Mr. Carroll.

RESPONSE OF MR. EDWARD W. YOUNG.

Mr. President and Members of the Master Boiler Makers' Association:

It is usually the custom in continuous performance houses with up-to-date theatrical managers, to put on what is known as a "chaser," especially when business is good, who will disgust at least part of the audience so much that they will get up and go out and make room for those waiting outside. I am making this apology for our President for putting me on so early at this stage of the game. I have our President to thank for the honor of being permitted to reply to Mr. Carroll's fine address. You have heard what he has said and you all know the importance of the subject he dealt with and we will all be much benefitted by the talk he gave us.

As I am here as a substitute for our Canadian member, if I become a little foreign in my response, I hope you will pardon me. I want to say a few words about these meetings. No doubt the older members here will remember former criticisms of these meetings, for which there was no reason whatever and I want to say a few words along those lines. The meetings of this Association remind me of a story a friend of mine told me.

A physician went to Vienna to take a post-graduate course. He learned that at an early hour in the afternoon, professors, students and all connected with the Medical College quit work and put in the remain-

ing hours of the afternoon at some coffee house, where they sat and chatted. He at once determined not to waste his time around a coffee house. He came there to learn and to study, not to talk and idle away the hours at a public house, but he could not make this stick.

The old saying is, "When you are in Rome, do as the Romans do." He had to fall into the footsteps of his teachers and colleagues and go to the coffee house too. Very soon a light dawned upon him. Instead of idling away his time, he found that the hours spent there were of the greatest educational value. It was there he met men, like himself, trying to learn the same lessons, to solve the same problems, to overcome the same difficulties. There the text books were discussed, explained, and their errors eliminated by mutual explanations and informal conversations among men trained in the same line of work. It was the place where like minds met and the wit became sharpened by communing with one another. It was a case where the diamond helped to polish a diamond.

The meetings of our association have a like effect upon our members. We come together and learn from one another and teach each other. Here we learn each other's troubles in boiler building; we are taught new and improved methods, we mutually help each other in overcoming difficulties, in avoiding trouble. What may have seemed an almost insurmountable obstacle, may have been easily overcome by you, or vice versa. These meetings are the boilermakers' school, in which we are all scholars and teachers at the same time. They are the clearing house, where we exchange our experience for that of others. The place where we receive and give knowledge. The time devoted to these meetings of ours is not lost or wasted; it is time well applied. We leave here as wiser and better men in our line. We all add to our common fund of knowledge in the art of boiler making We not only teach each other, but by discussion we broaden and more firmly fix the grip upon our own knowledge and make it more useful to us and our trade. To me, these meetings have been most profitable. I hope that they may ever continue and that for the good of the world every line of human endeavor may have gatherings of those interested. It will make more efficient men and by making them better, make a better world for all.

Mr. Carroll, permit me on behalf of the Master Boiler Makers' Association to thank you for your presence and assistance in opening our convention this morning with your most able address. I hope you will have time to meet with us during the rest of our stay in Cleveland, and on behalf of our Association I extend an invitation to do so. I thank you. (Applause.)

THE PRESIDENT: We will now go back to the regular order of business carried over from Wednesday. The first subject is, "Do Long Flues Which are of Such Length and Thickness That They Sag Upon Being Applied to Boiler, Vibrate With the Momentum of the Locomotive When in Service?" Mr. C. L. Hempel, Chairman.

REPORT OF COMMITTEE ON

"Do Long Flues Which Are of Such Length and Thickness that They Sag on Being Applied to Boiler, Vibrate with the Momentum of the Locomotive in Service?"

Your committee has been unable to gather any statistics from practical tests made other than an abstract from the New York Railroad Club of May 20, 1910, in which some tests were made relative

to the movement of flues. Said abstract will be read in connection with this report and is as follows:

To ascertain, if possible, why the back flue sheet, and the front one, too, for that matter, became deflected or distorted, about one year ago the New York Central, at the West Albany shop, installed a set of flues in one of their large Pacific type locomotives with a view of determining whether or not certain theories we had were correct. The theory was that, while the locomotive was working and the fire hot, with the circulation good, the expansion in the boiler proper (between flue sheets) was greater than that in the flues. The results of this test were rather remarkable, as will be seen later. The standard gauge flue on the New York Central is No. 11 B. W. G., and for this test No. 13 B. W. G. was used, one-half of which, as shown in slide No. 5, the double ring being safe-ended with No. 11 B. W. G. and the other half, the single ring, were not safe-ended. The manner of setting this set of flues, insofar as expanding, etc., are concerned, was our standard practice, with the following exceptions:

Our Supervisor of Boilers, Mr. Linderman, personally supervised this job, and each flue, before it was stuck at each end, was depressed at the center $1\frac{5}{8}$ inches, Mr. Linderman personally doing the depressing and, at a signal from him, the man at each end stuck the flue in the sheet and expanded it. The whole set of flues (382) was applied in this way, and as a result the whole set of flues had a sag of about one inch more than the normal when the job was completed.

Slide No. 15 is a view of the setting above described. You will notice that a needle was attached to one of the top flues at the center and extended up through the shell, and was attached to a recording device to show what, if any, movement took place under the various conditions of service from the time the fire was started in the box until the completion of a trip on the road.

Slide No. 16 shows the movement of the tube, to which the neddle was attached, from the time the fire was started until 200 pounds pressure was raised. It will be noted that almost immediately after the fire was started the needle began to pull downward and continued in that direction until it had pulled downward fully $\frac{1}{16}$ inch, and remained practically stationary for a few moments, then began to rise, as shown, and continued in that direction until about $\frac{1}{8}$ inch above the normal position, at which point the steam pressure began to raise, and the rise of the needle from that point up to 175 pound pressure was gradual; but very rapid from 175 pounds to 200 pounds, with the result that the total rise of the needle above the normal line was $\frac{1}{16}$ inch. We cannot account for the rapid rise of the needle between the time the pressure increased from 175 pounds to 200 pounds, unless it might be that the needle did not work in the stuffing box quite as freely as it should, but we cannot see how that could have been so, as the packing in the stuffing box around the needle was very loose.

Arrangements were then made to make a road test, and the record made by the recording device used will be shown in the next slide. This road test was made, as was the shop test, by Mr. Linderman and Mr. McPartland, the latter an engineer of long experience in testing locomotives and their appliances.

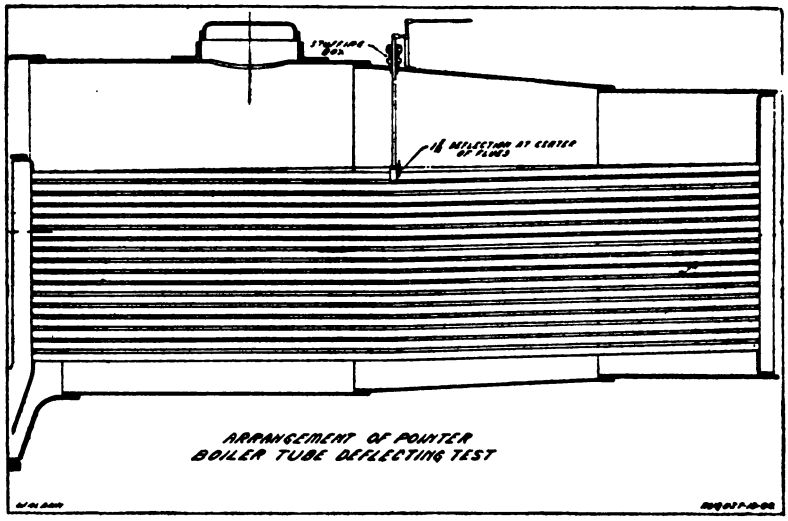
Slide No. 17 is a record made by the recording device on the first road trip, which was from West Albany to Rotterdam Junction.

It will be noted that, immediately upon starting out, the needle

began to pull downward, as shown by the solid lines; the dotted lines being the record made after the throttle was closed and while drifting. The maximum downward pull on the needle was $\frac{3}{16}$ inch, this point having been reached while the engine was being worked hard and running at good speed.

Slide No. 18 is a record of the second road test, which was made from Utica to Palatine Bridge. We cannot explain the rise of $\frac{1}{16}$ inch above the normal line at the start of this trip, but it will be noted that it did not occur again on the trip. The balance of the record, you will observe, is nearly a repetition of what occurred on the first trip, the increase on the downward pull on the needle, in our opinion, being due to the engineer who was running the engine on this trip working the engine harder than did the engineer who handled it on the first test, the maximum increase in pull downward on the needle being $\frac{5}{16}$ inch. The breaks in the card indicate the periods during which the apparatus was cut out while switching was being done; and the line at the right of the card, which shows the needle raised to the normal line, followed quite a long stop at a station.

This engine was afterward put into regular service on heavy passenger trains, and at the same time another engine of exactly the same class, having a set of standard No. 11 B. W. G. flues, set to



correspond with standard practice, was put on in the same line of service, and an accurate record of the cost of maintenance was kept of both. The engine with the special flues and special setting, in making 69,856 miles, never failed, while the engine with standard flues and standard setting, in making 71,774 miles, had a few detentions charged to it on account of "flues leaking." The cost of maintenance of both engines is as follows:

Special flues and special setting:
Cost per mile for flue work at engine houses..... .0143
Standard flues and standard setting:
Cost per mile for flue work at engine houses..... .0195
Percentage in favor of special setting..... 26.7%

At the time these figures were made up there was no perceptible difference in the condition of the flues in the firebox of either engine, and the No. 13 beads seem to have stood the working as well as the No. 11 beads, which we believe to have been due to the fact that the No. 13 beads did not leak as often as did the No. 11 beads, and therefore did not require to be worked as much.

We also note from the Proceedings of the Master Boiler Makers' Association held in Buffalo, N. Y., May, 1905. There was considerable discussion upon the sagging vibration and movement of flues while the engine was in service and it was well established that flues would sag more or less according to the length. This sag was considered beneficial and that there could be no vibration with flues submerged in water, but that flues would move to some extent with the surge of the water.

C. L. HEMPEL, Chairman
HARRY F. WELDIN
FRANK FISCHER
FRANK GRAVES

THE SECRETARY: The report has been printed in advance and distributed to the members. Following established precedent, the Secretary takes the liberty of suggesting that you go right to the discussion as three subjects were left over from yesterday.

MR. POWERS: I make a motion to that effect. Carried.

THE CHAIRMAN: Has anybody anything to say in regard to this subject?

MR. GRAY: This subject has been much discussed in our conventions. I don't know that it is necessary to read the report as everybody has a copy, and I don't know that I have much to say on the subject. I had some correspondence with the chairman of this committee and gave him all the information I had. We never found any more trouble in maintaining the long flues than we did the short flues. The long flues they gave us much less trouble and greater mileage, even up to those 22 feet long, which are the longest with which I have had experience.

MR. WELDIN: Mr. Chairman, I wish to say that the experiments were made by Mr. Hempel himself. I am trying to find him as he may have something to say on this subject. The report was simply submitted as a joint report and by reading the report you will find out about all the committee can tell you on the subject.

MR. D. A. LUCAS: I will tell you of an experience I had the other day as I claim that the flues vibrate. After a switch engine we had in the shops seven or eight months ago received the flues, a test was made. It was necessary to pull the flue on account of a leak in the weld. In pulling the flue the workman neglected to get the copper out and it lodged in the

boiler, about halfway between the two flue sheets. The engine was in service from that time until the other day when it came in with a burst flue After the flue was removed I found that it had rested on the copper and it has been worn by the vibration. This convinced me that the flues vibrate or this would not have occurred. The peculiar thing was that the hole was worn in the steel flue and the copper did not show wear. The longer the flue the more vibration we get.

MR. CONRATH: For the information of the younger members of this Association I beg to say that this problem has been pretty well threshed out by committees appointed on the subject in the early life of the Association and the reports of these committees would indicate that the long tubes are no harder to maintain than the short ones. In fact, in my opinion, the longer the tube, the more flexible it is. It will, therefore, yield more readily by bending in the center and relieving the expansion easier than the shorter flue, which naturally would be more rigid. As to the vibratory action of the flue in the boiler while in service, I do not believe there is much in the idea, as there is nothing more solid than a body of water. The water will float or carry the flue. Some flues are in service, I believe, on the Great Northern that are 24 feet long and from what I can learn they have given them very good results. Other roads have two inch tubes in Mikado type engines 21 feet and 22 feet long and they have not been found any harder to maintain than the shorter tubes.

MR. WESTOVER: About five years ago we bought several Mikado engines from the Baldwin Locomotive Works. The flues are 20 feet 6 inches long between the flue sheets. On the engines west of the Blue Mountains we did not experience trouble with the flues—with vibration striking on the head of the rivets, but on the engines working in the mountoins, east and west of La Grande, we began to have trouble with leaking flues. At that time we removed the flues, and on inspection found the vibration of the flues on the interior of the boiler was striking on the head of the first course of flues. On several of the engines it was necessary to remove the rivets from the seams, countersink the shell inside and drive flush rivets; therefore, it goes to prove that long flues will vibrate in the boiler. The distance from the center of the flue was two and three-quarters inches to the bottom of the shell; the flue was two inches in diameter and the height of the rivets one inch on the inside of the shell. Therefore, the flues had three-quarters of an inch clearance, and they must have vibrated or sagged that distance to wear a hole in the flue.

MR. WANDBERG: We do not experience any particular trouble with leakage. We have great trouble with the front flue sheets cracking at the knuckle. Is that due to the length of the flues or some other cause? On the shorter flues we don't have that trouble. In all engines with 19-foot flues we have considerable trouble with the cracking of the flue sheet on the front of the flange and also on the bottom, but not in any other class

of engine. I would like also to be enlightened on why the longer the flues the worse the pitting. Is that due to the vibration of the flues or is it because the long flues have a tendency to make the flues pit more? On some divisions we get about 10 months; that is all we can depend from a set of flues. We think we are lucky if we get twelve or fourteen months.

THE PRESIDENT: Do you weld your flues?

MR. WANDBERG: That doesn't seem to make any difference. They are all cold drawn steel or iron tubes, and they all pit. They are all two inch flues and we have trouble with the flues in high pressure power.

THE CHAIRMAN: Will Mr. George Hackman say a few words on this subject.

MR. HACKMAN: I can't say much on the subject. I haven't gone into it very deeply, but from my experience I would say that they don't vibrate very much. I have not found any such conditions as were mentioned about a flue 21 feet 6 inches long. I found it gave equally as good service as the shorter flues. So I haven't very much faith in the vibration and sagging of flues. I don't think there is anything in it.

MR. HEMPEL: I don't know that I have anything more to say than the committee has said. In my opinion, however, vibration cannot take place in the boiler that is filled with water; vibration can take place if the boiler is empty; the movement of the flue is due to the surge of the water, the water going up and down and sideways; but as far as vibration is concerned, I don't think there is any. Those are my personal views, and a slight sagging of the flues, in my opinion, is beneficial. I say that for the reason that when the water moves back and forth the flues raise up and down and it gives them a chance to pulsate properly. If it was tied rigid it would be like a rigid bolt; have no chance of movement, and I am of the opinion that the pulsating is beneficial.

MR. GRAY: This discussion, like many others, is bringing out contrary views. Mr. Wandberg said that the cracking of the front flue sheet was more prevalent in long flues than in short ones. Our experience is quite the contrary. We have more trouble with the flue sheets cracking on engines equipped with flues up to 12 feet. We have never found any cracking on the front flue sheets yet, where the flues are from 16 to 22 feet. We may have overcome our troubles by putting in three-quarters front flue sheets. I think that helped to do so.

MR. KNAUER: About three months ago in inspecting the interior of a boiler, I found that the tubes had a groove worn in nearly half way

through the thickness of the flues, and we had to remove them. It shows that the flues vibrate.

MR. GEORGE L. FOWLER of New York City: I have a suggestion to make that possibly may clear up this matter. It may be due to the condition of the tracks. We find that the cars vibrate more on a rough track than on a smooth one, and possibly the tubes may do the same. With regard to the long flue sheets pitting more than the short ones, I suggest that the metal is under more stress in the long tubes and will therefore more readily corrode because of the excessive vibration to which it is subjected; therefore, according to logic, the long tubes ought to corrode more than the shorter ones, and if they have any sense of propriety they will.

MR. D. A. LUCAS: As I asked that question for information, and as I am not satisfied with the discussion as it is at the present time, I move that the subject be continued next year. Carried.

THE PRESIDENT: The next subject will be, "Why Do Front Flue Sheets Bulge and How Can It Be Eliminated?" John B. Tate, Chairman; John B. Smith and Martin Murphy, committee.

REPORT OF COMMITTEE ON

"Why Do Front Flue Sheets Bulge?"

Your committee has endeavored to make the report on this subject brief and we have worked up the following information which was gotten by actual test:

The sheets have a very small amount of material to assist in keeping it straight. The amount of work and the tools used, as well as the experience of the man doing the work of putting in the flue, governs the bulging of the sheet, which the following record and experiments will conclusively show with reference to the effect of the various methods used for fastening the flue in the front end.

By using the rollers by hand each hole stretched .007 of an inch. With the self-feeding roller and hand pin the hole stretched .029 of an inch. With the self-feeding roller and air motor the hole stretched .021 of an inch, and by taking for a basis a flue head having 400 holes in it, the first method or hand rolls, we stretched the holes 400 times, .007 which equals 2.8 inches. The second operation, that is, self-feeding rolls and hand pin we stretched the holes .029 of an inch or 400 times that which equals 11.6 inches. The third operation or self-feeding rolls and air motor, we stetch the hole .021 of an inch, or a total of 400 holes of 8.4 inches. The amount of excess material is distributed over the space worked upon.

As the bridges between the flues do not upset proportionately to the increase in the sizes of the holes to do the stretching of the material at certain points, each individual hole must take care of a portion of the material round it, thus making the bulging of the sheet a local condition.

This test was made with ½ inch sheet, 2 inch flue, .135 inch thick.

J. B. TATE, Chairman
JOHN SMITH
MARTIN MURPHY
Committee

MR. TATE: I don't see any necessity for reading the entire paper as each member has a copy. I hope members will understand that the committee tried to do this from a scientific standpoint, we went into the matter very thoroughly. We did not deal with anything but actual facts. We had no prejudice, we did not allow our feelings to enter into it, neither did we allow our practical knowledge to influence us. We had surmised that the bulging of the front flue sheet was largely due to the man who had applied the flue, or the tools he had used. In order to bring it clearly before the convention, that we might be able to definitely settle the subject of the bulging of the front flue sheets, we took a piece of steel 40 inches long and 30 inches wide, laid it out, and had the holes applied the same as located in the flue sheet. We put on an experienced man with a hand roller and you will find the results in the report. If you put on an experienced man with a hand roller he will show you results. You will note the results obtained with a hand roller and a self-feeding roller. In general practice you all know it is impossible to upset the front flue sheet bridges uniformly. Some parts of the flue sheet are softer than others. The question arose that in each operation, if we stretch our plate as outline in the report—of the operation and the results —what can we expect after four or five renewals of the tubes? Therefore, when we get the sheet stretched to such an extent, it is bound to bulge and we cannot get it back. It is impossible to straighten it as it originally was, and if you attempt to do so, where will it go? After going through this matter and spending a good deal of time we have concluded it is actually due to the tools used and the man applying the flues. (Applause.)

THE PRESIDENT: Mr. Hodges, would you like to give your views on this subject?

MR. HODGES: Several causes contribute to the bulging of the front flue sheet. Chief among them is the rolling of the flues in the front flue sheet which the report of the committee shows conclusively. Under the old method, when flues were rolled by hand, the bulging of the front flue sheet was extended to that which was expected of it. Under the present order when flues are rolled with an air motor and with a strong pressure of air, the stretching of the front flue sheet in the flue area is enormous. This excessive metal must travel, and the tendency is to move outward to the shell of the boiler, which it does, and it only stops when it meets with resistance from a greater force. The outer shell of the boiler in which the flue sheet is incased, forms a barricade, and refuses to permit

any more movement in that direction. This compels the flue sheet to bulge either towards the front end of the smoke box, or backward towards the back flue sheet. In the application of a new sheet, it will, when completed, look very good, if properly applied; but stresses and strains are set up which are only relieved when the boiler is fired up and the outer shell expands. When the boiler is cooled down, contraction takes place, forcing the excessive metal back into the flue area or else compels the flue sheet to bulge either backward or forward. This movement and working of the sheet is repeated every time the boiler is fired up and cooled down, the result being that the sheet is distorted, bridges are broken, the knuckle of the flange is pitted and deteriorated in thickness, if not badly cracked, and the life of the flue is prematurely destroyed. Not only all this, but on account of the back and front flue sheet being tied together with flues, it logically follows that whatever the effects one is bound to have a corresponding effect upon the other. Unquestionably the bulging of the back flue sheet is primarily caused, and I might say continued, from the bulging of the front flue sheet, for the rim of the back flue sheet is not held fast by the outer shell, as is the case with the front flue sheet, but has ample space for it to move—and it does travel. Thus provision is made for the expansion incurred in the application of flues in the back end. Not only is this a fact, but outside of the improper handling by enginemen, and extremely bad water conditions, the bulging of the front flue sheet is the basic cause of flue leakage in the firebox end. At least it is a contributing factor to leaky tubes, and an abridgement of the life of the firebox.

How to overcome the bulging of the front flue sheet is a phase of the report which was not considered by the committee, though to my mind this is of vital importance. We have the cause, and the effect, but where is the remedy? The bulging of the front flue sheet cannot be overcome by applying a thicker sheet. Expansion and contraction cannot be excluded in this manner. It cannot be eliminated by the proper application of the back and front flue sheet in the first place. This is desirable, and will assist greatly in contributing to this end. The fact of the matter is it cannot be overcome, but provision must be made to transfer the expansion and contraction to other localities. To do this, a sheet should be designed with a corrugation around the outside circle of the flue sheet, in the knuckle of the flange, and another corrugation across the top row of flue holes intersecting the corrugations on both sides. The corrugation should be deep and narrow, so as to permit a great deal of flexibility, and, at the same time, not take up too much space. Then when the sheet is expanded by the rolling of the flues,, all of this excessive metal will be forced into the corrugations, and the stress and strain will not be in the flue area. Therefore when the boiler is fired up, and the temperature is raised, there will be no movement to speak of in the flue area, but the expansion will be located in the corrugations. I am satisfied that if a front flue sheet is so designed and applied correctly, that not only will we eliminate the bulging of the sheet, but a great deal of the trouble we are hav-

ing with leaky flues, and the bulging of the back flue sheet, will in a large measure be overcome, and another step be taken in the proper design of the "Ideal locomotive boiler."

MR. WANDBERG: In applying the corrugations to the sheet, would the number of flues have to be reduced? What number of flues would have to be removed?

MR. HODGES: The corrugations should be made deep and narrow so as to take up as little room as possible, and the spacing of the flues can be reduced a little without any bad effect. If this is done, I do not believe it will be necessary to eliminate any of the flues.

MR. A. N. LUCAS: Would that prevent cracking around the flue hole, around the flanges? We all have front flue sheets that have been in service from 10 to 30 years, and, ordinarily, with proper care, the front flue sheet will outwear the boiler. In many instances, it is next to impossible to put the corrugations all the way around owing to the dry pipe hole coming next to the flange, the reinforcement around the hole, the reinforcing plate, etc., as well as the gussett stay. I don't know that the corrugation around the flue sheet would help. I have had about 35 years' experience. We have three-quarter flue sheets in our engines and we have no trouble with them. If the thickness of flue sheets is increased the expansion and contraction of the flues have a tendency to make them crack in the root of the flange all the way around the hole—not bulge but crack. To overcome that we have put three-quarter front flue sheets in oil burning engines, and in some cases we have had a back flue sheet crack; in the same way we applied a five-eighths back flue sheet, and are getting good results. We have had experience along this line. It is not new with us. We have certain classes where the back flue sheet is five-eighths and we find in those engines we are getting the best results. They are all combustion chamber engines, have a five-eighths back and three-quarters front flue sheet, and we have had no trouble with bulging of the front flue sheets. I think you will find in almost all cases it is due to giving the man too large a motor and then not putting a competent man on the work. In that case he distorts the hole. In a number of cases you will find the man is using a big motor, and the flue sheet is distorted from two to two and one-half inches, which is not due to service, but to the poor judgment of rolling the flues at the front end.

MR. J. L. DIDIER: I have had some experience with the bulging of the front flue sheets and also the back flue sheets and I have overcome it by fastening eight flues on each side of the back flue sheet, using braces, and the engines that I have equipped with those braces have never given any more trouble. This might be a benefit to someone else.

MR. D. A. LUCAS: I have had experience with the bulging of front flue sheets. I can't agree with Mr. Didier's view, that it is due to the man who put them in wrong. I think that a great deal of the trouble is in the first operation of the flue sheets. We flange the flue sheet and straighten it and set it so that it is absolutely straight. If a little too tight it will bulge in, and if loose it will bulge out in the first operation. I have found that it travels considerably. By putting in copper you can get one-sixteenth of an inch of travel up. You will see that the sheet starts to move right from the first operation. I think that the trouble of flue sheets bulging is such a small matter, such a small factor in our troubles that it is hardly worthy of discussion. We have flue sheets that wear the boiler out. They run from 10 to 15 years and they are not giving any trouble. I know that many times and in a great many places it was the practice to straighten the sheet with a bar bolted across the flue sheet, pulling the sheet up to the bar, and the back sheet might bulge. They would straighten the back sheet, letting the front sheet go, and they had no bad results; but we find that as the flue sheet grows older the bulging increases, due to the stretching of the bridges and the working of the flues, which it is almost impossible to overcome if the flues are worked hard enough from time to time to make them tight in the front end.

MR. J. L. DIDIER: I have had some experience with the bulging of front and back flue sheets. The bulging, in my experience, is caused by expansion, contraction and loose flues, or leaky flues, and find that the front flue sheet generally bulges in, and the back flue sheets bulge out.

When an engine is fired up the flues are the first to get hot and begin to expand. This will put a pressure on both flue sheets, more so on the back flue sheet, as it is the thinest and the hotest. The flues being rolled tight in the sheet will expand to a certain extent, and then compression takes place, as the flues expand so much quicker than the flue sheet owing to difference in thickness. That is why a copper ferrule is used to take up the difference as much as possible in the expansion between the back flue sheet and the flues. The sudden expansion of the flues will invariably cause compression, and a sudden contraction of the flues will cause leaky or loose flues. Generally this takes place in the middle and lower part of the back flue sheet.

The boiler pressure on this particular part of the boiler with loose flues, will cause the back flue sheet to bulge out on account of a lack of bracing from the flues. The tight flues around the loose flues having a much greater load to hold, with the surface of the loose flues, it will have a tendency to pull the front flue sheet in. To overcome this, I am applying two gusset braces made of three-quarter inch material, each brace fastened to the belly of the boiler with six one-inch rivets, and fastened to the back flue sheet with six Tate Flexible Stay Bolts. The flue holes in the front flue sheet, on account of the gusset brace, can be filled in with stay flues, connected to the gusset brace, or they can be plugged or pocket

flues put in. I have had engines running in my territory for the past six years with braces, and no trouble with flue sheets bulging has occurred since braces have been applied.

MR. A. N. LUCAS: I would like to square myself, if you will allow me. When I told you my experience, I was talking about the front flue sheets and the life of them. I said we were getting from 20 to 30 years out of them, and if we were to get the life out of other sheets in the boiler that we do out of front flue sheets, we would not have much trouble. I want you gentlemen to take notice of the front flue sheets. Many of you look at the back end and I know of some foremen who got the back end conditions and forget the front end entirely. When visiting your neighbors' machine shops take a look at the front flue sheets. I have seen cases where it was one inch greater thickness at the flue hole practically rolled out. I am not talking about corrosion. When that happens it is due to the elements and if you can protect it, alright; but I am talking of bulging, and the cracking of the flue sheet around the root of the flange. The rolling has more to do with them than anything else.

MR. WINTERSTEEN: How long have the three-quarter flue sheets been in service?

MR. A. N. LUCAS: I said we had three-quarter front flue sheets and we had no trouble due to bulging or cracking.

MR. WINTERSTEEN: How long have they been in service?

MR. A. N. LUCAS: Seven or eight years.

MR. WINTERSTEEN: That is just the point; he never had any trouble, but he will if he waits long enough.

MR. A. N. LUCAS: I said we have had enough of those three-quarter flue sheets in service to give us an idea of how they work, of their advantage over the half inch.

MR. WINTERSTEEN: We had the half inch front flue sheets and about 10 or 12 years ago they started to give out and caused all kinds of trouble. They were 8 to 10 years old when they began giving out. We took them out, put in three-quarter inch sheets, and thought that we had overcome the trouble, but when they were seven or eight years old they cracked and became impaired just the same as the half inch. My experience has been that you get as much life out of one as you do out of the other.

MR. YOUNG: A perfect fit is very essential to prevent bulging. If the sheet is giving a perfect fit, roll the flues just enough to make them tight.

You have done all you can to overcome this trouble, and there will be but little or no bulging, but changing the flues from time to time will bring on the bulging to a certain extent as the rolling will make the metal thicker at the rolling edge. An improper fit, whether it be too large or too small, will cause considerable bulging right at the start.

MR. J. O. CRITES: I wish to agree with the member who was just on his feet. I had experience in that line with regard to front flue sheets bulging. The Pennsylvania Railroad received an engine from the Baldwin Locomotive Works and the first time the flues were taken out it was found that the sheet bulged one and one-quarter inches. Was it in that condition when put in, or was the bulge due to continued expansion and contraction up to that time? I know cases where they pulled up the sheet straight and tacked it with the flues, then took off the bar and put in the remainder of the flues. When the flues were again taken out the bulge came back.

MR. HEMPEL: Possibly several members are here who have used corrugated flue sheets. We have had one engine of the wooden typ with a front and back flue sheet, both corrugated; but the life of that box was so short in our bad water district that we did not get the full value of service on the front flue sheet. However, when we removed that front flue sheet, corrugated all the way round, and also the back flue sheet, they were both bulged, the front flue shet about half an inch more than the back. The back flue sheet had gone out, working away from the fire. It had bulged about half an inch and the front about an inch in 28 months' service. Probably some of the members who are connected with the New York Central can tell us about what they have been doing. I think possibly this corrugating will overcome some of the troubles. I believe that is what some of the members think, but I am afraid from my personal experience that it will not stop bulging. I think the trouble is about as Mr. Lucas explained, that the continual rolling thickens the metal at the flue sheet hole and would make it wider. If you caliber the thickness of the sheet at the rolling edge and at the centre of the ridge, you will find it thicker at the rolling edge, therefore an excess of metal is stored there and this aids in bulging. I think that you should roll your front flue sheet as lightly as possible and then you have done about all you can do, unless we get some other method of construction.

On motion of Mr. Madden the discussion was closed.

THE CHAIRMAN: The next report in order is, "Best Method of Cleaning and Maintaining Superheated Flues." T. F. Powers, Chairman; W. M. Wilson and Thomas W. Lowe, committee.

REPORT OF COMMITTEE ON

"Best Method of Cleaning and Maintaining Superheater Flues"

Since the number of superheater engines is increasing every year, the method of cleaning and maintaining superheater tubes is a very important one, for nothing decreases the efficiency of the superheater more than dirty or clogged superheater tubes.

Keeping superheater tubes free from cinders and clinkers, of course, depends upon the roundhouse forces, and more particularly upon the Boiler Foreman and Inspector. It is very important that superheater tubes be inspected before each trip. Flash lights or electric lights with shields should be provided for inspecting. It should be required that the clinkers and cinders be removed from the superheater tubes at the end of each trip, and if necessary they should be blown out. Steel bars from five to eight feet long with a chisel point should be used to break up the clinkers and honeycomb off of the end of the unit. Other bars with hooks at the end should be used to pull the clinkers out of the tube, and it is very important that all the clinkers and honeycomb be removed from the tube, for if these are blown back into the tube they are liable to lodge on the bands or supports of the unit pipes and will soon clog the superheater tubes. A ¼ inch or ⅜ inch pipe not longer than the tube should be used for blowing out the soot and cinders, care being taken that the pipe is run under the unit pipes, and pulled back and forth until the tube is cleaned.

The best time to clean the superheater tubes is, of course, at the washout period when the engine is cool, but this depends upon the grade of coal used, for with the use of some coal it is necessary to blow and clean superheater tubes each trip. Sometimes superheater tubes become clogged at the front ends, owing to clinkers and honeycomb being blown toward the front and allowed to lodge on the unit bands or supports. Therefore, an electric light should be shoved through the peep hole in the smoke-box and tubes be inspected their full length, in order to avoid this condition at the front end.

As it is not necessary to remove the superheater tubes at the end of the three-year period in order to comply with the law, if the boiler can be cleaned and inspected, it is, therefore, recommended by many railroads that the superheater flues be welded at the fire-box end. The tubes can be cleaned on the outside or water side while in the boiler by the use of scraping rods and bars, pneumatic flue cleaners, and sometimes by heating the tubes. When it is necessary to remove the superheater tubes they can be cleaned in the flue rattler.

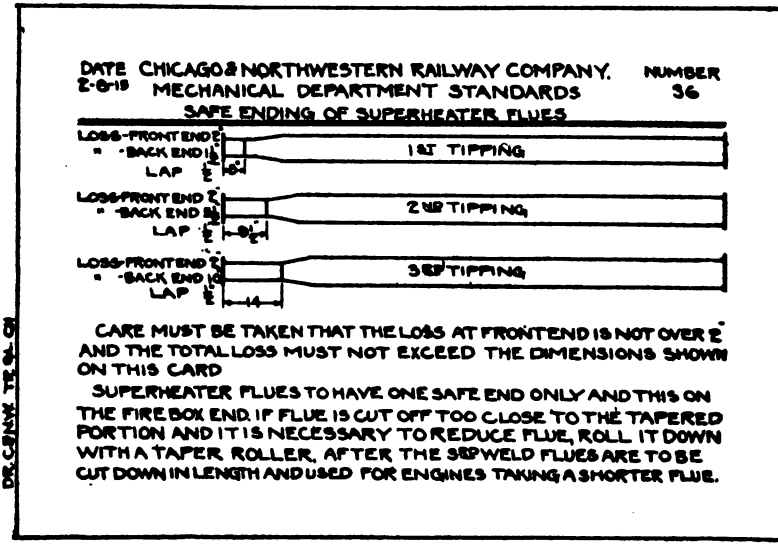
When it is necessary to safe end superheater tubes, many railroads recommend that not over one safe end be used. When the old safe end is cut off each time it is at least possible to re-tip the tube three times. After that they can be cut down for shorter engines.

It is the recommendation of this committee and other Boiler Foremen that the safe end go on the fire-box end, where the condition is more severe, and where the new material is most needed.

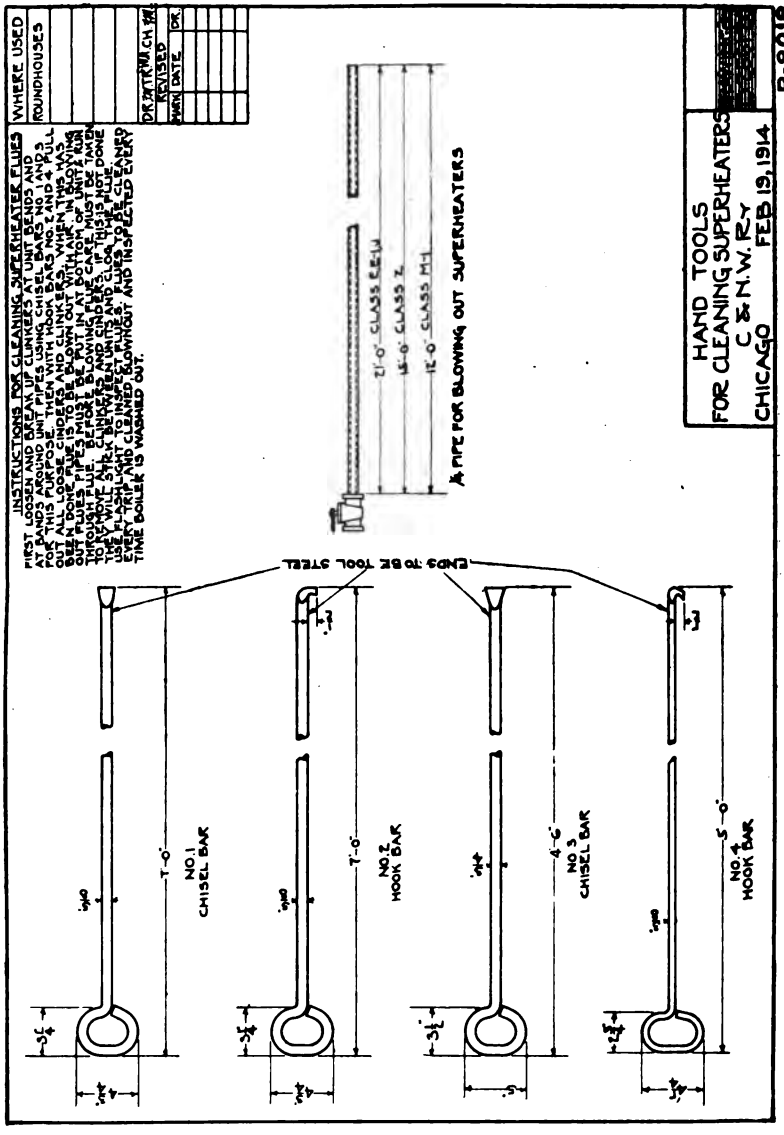
There has been a tendency on the part of some designers to crowd the corner superheater tubes too close to the flange of the back flue sheet. This has resulted in cracks out from the flue hole and they can only be repaired by welding, and where the welding

does not hold, it is necessary to renew the flue sheets. It is, therefore, recommended that the outside edge of the superheater flue hole be kept at least 3 inches from the inside of the flue sheet flange.

T. F. POWERS, Chairman
W. M. WILSON
T. W. LOWE



MR. POWERS: I don't think it necessary to read this report, and with your permission will not do so. I wish, however, to call your attention to the fact that it is the opinion of the committee that the kind of coal used on superheated engines has much to do with the maintenance; that is in keeping the superheater flues clean. Another thing that enters largely into it is the inspection. The superheater people themselves have deemed it necessary to have very careful inspection of their superheater flues; so much so that they have put inspectors out on the road. They send them to the various railroads to see that the superheater flues are kept clean. I know of no proposition coming before the Master Boiler Makers that will demand as much attention and save more money for the railroads they represent than keeping the superheater flues clean. It is also the opinion of the committee that the best method of safe-ending is to put the safe-end on the back-end and never have more than one weld. Another thing presented to the committee by various members is that the superheater flues, in being welded, should never be put back in the fire the second time. We all know that if we have a superheater flue burst, it is almost as bad as an explosion.


INSTRUCTIONS FOR CLEANING SUPERHEATER FLUES
FIRST LOOSEN AND BREAK UP CLINKERS AT UNIT BENDS AND AT ENDS OF FLUES USING HOOK BARS NO. 2 AND 4. PULL OUT ALL LOOSE CINDERS AND CLINKERS. WHEN THIS HAS BEEN DONE FLUE IS TO BE BLOWN OUT WITH AIR OR STEAM THROUGH FLUE BEFORE BLOWING IN FIRE CARE MUST BE TAKEN TO REMOVE ALL CLINKERS AND CINDERS, IF THIS IS NOT DONE USE FLASHLIGHT TO INSPECT FLUE AND FLUES TO BE CLEANED EVERY TRIP AND CLEANED BLOWNOUT AND INSPECTED EVERY TIME BOILER IS WASHED OUT.
WHERE USED
ROUNDHOUSES
DR. BY TRM. CH. BY
REVISED
MARK DATE DR.
21'-0" CLASS E & J
18'-0" CLASS Z
12'-0" CLASS M & L
A FIFE FOR BLOWING OUT SUPERHEATERS
ENDS TO BE TOOL STEEL
7'-0"
NO. 1 CHISEL BAR
NO. 2 HOOK BAR
4'-6"
NO. 3 CHISEL BAR
5'-0"
NO. 4 HOOK BAR
HAND TOOLS FOR CLEANING SUPERHEATERS C & N.W. RY CHICAGO FEB 13, 1914
B-8218

MR. LEWIS: As Mr. Powers has just stated, we all realize that keeping the superheater flues clean is a very important work; that it must be attended to because the tubes get clogged with dirt and then we lose the good qualities that we gained. I make it one of the interesting points for myself, whenever I am in an engine house, to take notice that the tubes are properly cleaned because I realize the importance of it.

MR. POWERS: I would like to see brought before the convention the different methods used on various railroads in cleaning superheater flues—that is on the water side when they are not removed on account of the three years' limit. We have different mechanical devices, but we have not been very successful in certain kinds of water.

MR. D. A. LUCAS: I think the question is a little misleading. It speaks of superheater tubes. Some people in mentioning them may mean the steam units, but I think this question pertains to the superheated flues, not the tubes, the steam units. Do we understand correctly that we are to have a complete discussion of welding and caring for them, and keeping them clean?

MR. POWERS: It says maintaining.

THE PRESIDENT: Mr. Lucas, tell us how you clean them.

MR. C. R. BENNETT: We cut the flues in the boiler at both ends with acetylene gas; then we remove them through the dry pipe hole and place them in an iron cylinder rattler which is made of channel irons and cast iron heads or ends. The rattler is 60 inches in diameter and makes about 10 revolutions per minute. We rattle the superheater flues by themselves and we have never experienced any trouble with the flues being damaged in the rattler. In piecing out the flues we cut off part of the swaged end and weld on a new safe end eight inches long with one inch lap. We then test the flues with air pressure at 110 pounds. In replacing the superheater tubes in the boiler we follow the same method as when applying the ordinary small flues. In the round house we have one lead man and four laborers who inspect all the superheater tubes at the end of each trip and clean them by removing the honeycomb from the ends of the units with short rods or hooks, being careful that none of the honeycomb is left in the tubes before blowing them out with air. The flues are blown out with air pressure at 100 pounds; and a one-half or three-eighths inch gas pipe long enough to reach clear through the tube is used. In order to be sure that all the flues are clean, the leader of this gang inspects the work from the inside of the firebox by looking through each of the tubes while one of the laborers is at the front end with a lighted piece of oily waste attached to a rod holding it through the opening which is in the smoke box for that purpose. We also inspect the units in the front end each trip as

leaking units interfere with the steaming. If we are unable to stop the leaking of the unit by tightening the joint we have the unit removed and the joint reground and this method stops the trouble at least for a while.

MR. POWERS: How do you clean them when you don't take out the boiler?

MR. C. R. BENNETT: I found it was necessary to take the flues out every two years. Therefore, we have never tried to clean them on the inside of the boiler, and I have no remedy to recommend.

MR. HEMPEL: We have arranged a method of caring for the superheater tubes by cleaning without removing them from the boiler. We devised a flue pounding apparatus with a flange working outward, with air, and we get fair results from this. I do not think we can clean the tubes as well as by removing them. It is possible that we could if we wasted much time on them. When removing the small tubes, it is not necessary to remove the superheater tubes, if you can make your internal inspection; if not, it would be necessary to remove the tubes. On a certain class of power you cannot do that and you can clean the scale off sufficiently to give fairly good results. If you don't want to remove your superheater flues, the best thing to do is to put in a knocker and scale the best you can. We have a home-made knocker, but we are trying to find the best we can get on the market. So far this home-made one has done better work than any we have been able to buy, although you may be able to buy one that would be better. So far as the keeping up of the flues while in service is concerned, you all know the importance of keeping the flues very clean. In cases where the flues have gotten the best of you while on the road, and in some way have become clogged, if you can't get it out with air, or the usual method of rod and scraper, take the water; that is the best way, and we have not found a case where we could not with water dislodge the cinder that had formed; but in ordinary cases it can be dislodged with air and running the rod through.

MR. GRAY: We have been using superheater engines about six years and have tried to keep them clean while they were in service—keeping the interior around the unit clean. The only successful method was to have a special man attend to the superheater flues—one man for the small flues and another for the superheater flues. If he gets at that engine at least every round trip, we don't have any trouble in keeping the flues clean. The first thing is to take the clinkers out from the end of the unit with a hook and then with the aid of a pipe about 10 feet long, in some cases longer, blow through the tube until is entirely clear. We tried for a while to have the same flue blowers take care of both the superheater and the small flues, but we found it would not work. As to cleaning off the scale in the flues on the inside of the boiler, it depends very largely on the char-

acter of the scale. We have some that is a good deal like hard rubber and it can't be removed with the internal knocker. We have engines running in other districts from which the scale can be cleaned very nicely with the knocker after very little work. I think the only method for keeping the flues of the superheater engines clean is to have a special man look after them in the round house.

MR. WANDBERG: My experience with keeping the superheater flues clean is a good deal the same as Mr. Gray's and Mr. Hempel's. You can keep them clean with very little trouble if you look after them properly. As soon as the superheater flues become stopped up we have trouble. The band that holds the superheater units together is made about an inch and a half, and that itself, having more expansion and contraction than the tubes, wears a hole through if the proper care is not taken in putting them up, leaving a short and sharp edge of the band which keeps working in there, I have seen that in a number of our boilers. Now as to our method of cleaning them, we have localities where we can hammer and clean the flues very nicely, but on other divisions we cannot do the hammering, we can't knock it off, and in cases of that kind we have to take the flues out and I think it is the cheapest and best method. That has been my experience, gentlemen.

MR. A. N. LUCAS: Every time our superheater units are taken out, we run a cleaner through the large flues, whether they are clogged or have been. We find there is a coating of scale on the inside of the large flues. We run the cleaner through and knock it off and we find more in there than you would imagine. It has been found that considerable scale formed on the inside. When we take the small flues out we use the same tool we are using with the hammer on the inside of the boiler and we get off all we can. We also adopted a method of placing the bands on the units. Many times they were placed by one department that did not know whether the unit would go into the flues or not. So we give them a short piece of flue to go over the band, something for the machinist to go by. The bands were formerly placed in a proper manner so as to keep the units from vibrating. We have tested this out and I think you will get results with this method.

MR. BORNEMAN: I would like to hear something about the size of the superheater hole in the back flue sheet. Should it be the size of the flue, four and one-half inches, or three-sixteenths of an inch larger?

MR. A. N. LUCAS: The flue is four and one-half inches swedge to fit the shim; practically the same as the smaller flues.

MR. GRAY: As to cleaning the interior of the tubes after the unit is removed, we wash them out with about 100 pounds pressure and we get a better job. We always do it if only one pipe is removed.

A MEMBER: We wash them out.

MR. GRAY: We drill the flue hole in back flue sheets a quarter of an inch bigger than the flues. We have four inch and four and a half inch, with eight inch copper. Mr. Powers spoke about welding the superheater flues. We have a little heavier flue, I think, than most people use—about nine gauge. We use three-sixteenths and we weld altogether on the back end. After one heat and weld we use the roller and roll the weld about half way down; then take another heat and finish on down, so you can hardly find the weld. We have never had any failures with this weld in service.

THE PRESIDENT: I just want to call your attention to a gentleman, who, I believe, will enlighten us on the cleaning of superheater flues. He has traveled all over the United States and he is a tube expert. He is an old time boiler maker and he has not said one word on this subject. I will call on Mr. James T. Kelly to give us some information on this subject.

MR. KELLY: It is quite a while since I had anything to do with cleaning the tubes of superheaters. A member who was on the floor before me stated that the cleaning of superheater tubes is very essential. I want to say "Amen" to that because it is a fact. On the Northwestern Railroad when we first got the superheater locomotives I saw the superheater swedged in and filled up solid. We have taken the core out and it was from eight to 15 inches long. So that shows how necessary it is to clean the superheater engines. We had some trouble at first and we found that the superheater engines were not doing as good as the saturated, because the superheater flues were plugged solid. My advice to all who are having trouble with the superheater tubes leaking and the superheater engines not steaming is, go in and see for yourself; never mind what anybody tells you; get in with a torch or an electric light and see for yourself.

THE PRESIDENT: There is another question I would like to bring up in regard to the cleaning of superheater flues. After they are taken from the boiler I want to know whether the gentlemen here put them in the rattler along with the small flues or roll them separately?

MR. A. N. LUCAS: I have talked before on this subject, but I would like to give our experience. We put the superheater flues in the rattler alone and we find that we get the best results. When visiting other shops I found that they put in two and two and one-quarter inch flues with the

heavy superheater flues. This may clean the superheater flues a little bit better, but it raises the dickens with the smaller flues. The two and one-half inch flues were broken and jammed and they did not look very good to me. I think it is too hard on the smaller flues. In another case I found where some burrs had been put in and they were dented from one end to another and the only way, I believe, is to clean them by themselves.

MR. POWERS: On the Northwestern we have a submerged rattler in the ground, with water running through it. It has three arms and we first put our superheater tubes in there without any small flues. Instead of raising the dickens with the small flues, it did so with the superheater flues; so we put in the two inch and we found it did not dent the superheater.

MR. WESTOVER: We don't have any trouble. We can clean our superheater flues in about four and one-half hours.

MR. LEWIS: I don't agree with Mr. Lucas. We've had the same experience as Mr. Powers. We have a water rattler and at first put the big tubes in by themselves. We found that quite a number had dents.

MR. A. N. LUCAS: We have a dry rattler, old style.

MR. LEWIS: Well, we have a roller rattler, not submerged in water as mentioned by Mr. Powers, but we have the water running continually through it. We found that by putting in two and one-half inch tubes along with the superheater tubes, we got the best results. We did away with the dents in the big tubes and I don't know that we ever spoil the two inch tubes or the two and a quarter inch by using them in the rattler with the superheater tubes.

MR. D. A. LUCAS: We have the old style dry cylinder rattler. My experience is that it is best to rattle the tubes by themselves, but plenty of them must be put in. If there are not enough they pound themselves to pieces. If the rattler is filled full no bad results will be had.

MR. WANDBERG: I also have an old style dry rattler and I have just the same experience as Mr. Lucas, the same trouble; if I did not put in enough they would be flattened out, but when I filled the rattler I experienced no trouble. Some flues may not be as clean as others.

On motion of Mr. Lewis the discussion was closed and the committee discharged.

REMOVAL OF CAPS FROM FLEXIBLE STAYBOLTS.

THE CHAIRMAN: The next subject is, "To Obtain Extension of Time Limit for Removal of Caps, With Flexible Staybolts." C. N. Nau, Chairman; T. P. Madden, Bernard Wulle and C. P. Patrick, committee.

MR. NAU: I do not think it is necessary to read this report as all the members have received advance copies, but the committee is sorry to say that some of the railroads have given us incomplete and incorrect reports and the committee does not feel that it would be proper to allow this subject to be placed before the Association and go into the proceedings. It would be unjust to the Association, as well as these railroads. As a committee we feel that first of all anything that goes in the proceedings should be correct, so that in the future no one could criticise the committee or the Association. As chairman of this committee I want it understood that we are of this opinion. Of course, as chairman, I shall be obliged to leave it to the Association to decide what shall be done. I, for one, do not think that it should be placed in the proceedings. Therefore, I desire to make a motion to that effect.

THE PRESIDENT: I am satisfied that Mr. Nau is right when he claims that the report is not correct. It is a report of one shop instead of all points all along the line. They do not keep a correct report at the roundhouse and that is where you should go for information. We did not discover until it was too late that this report was not correct. Mr. Nau did not get the information from the men to whom he wrote. He wrote to the different foremen and only received a report from this one group; so it is not Mr. Nau's fault. The members of this Association did not make their reports as requested, that is, in writing. I think myself that the committee should be discharged and no more time wasted on this subject as I understand there is a new method being introduced at the present time, or will be in a few months, that will overcome the removal of caps without this Association trying to solve this problem. So I think some member should move that the subject be closed and do away with it entirely, and also that the report of this committee be not placed in the proceedings of our convention.

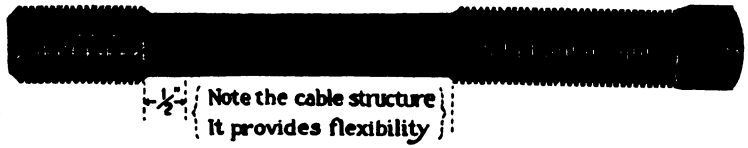
A motion was then made to this effect and carried.

MR. WANDBERG: It appears to me that this is an important subject and should not be dropped.

THE PRESIDENT: The report is incorrect.

MR. WANDBERG: I understand that, but I also understand by the motion just carried that the committee is discharged.

Why The American Staybolt?



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THE PRESIDENT: It can be brought up again at the next convention. The next subject on the program is, "What is the Most Economical Method of Removing and Replacing Wide Fireboxes in Locomotive Boilers." B. F. Sarver, Chairman; A. N. Lucas and Bernard Wulle, committee.

REPORT OF COMMITTEE ON

"What Is the Most Economical Method for Removing and Replacing Wide Fire-Boxes on Locomotive Boilers?"

Your Committee submits the following report:

In going over the detailed reports received from the different members of this committee I find the committee are practically of the same opinion as to how this work should be done, i. e. relative to the removing of the old wide fire-boxes. We also think the different conditions and facilities at the different shops have a great deal to do with just how this work should, and can be done.

If the shops are equipped with cranes, hoists, electric or oxy-acetylene processes for cutting and welding, mud-ring riveters and air tools of all types, it makes an altogether different proposition than when they do not have these facilities.

It seems to be the opinion of the committee as a general proposition that this type of fire-box should be removed in the following manner:

1st: After removing all flues, the boiler should be taken from the cylinders and frames and placed on the floor in the boiler shop, all stay and crown bolts drilled out with air drills, or cut off with the electric or acetylene processes, cutting mud-ring rivets off with hand chisels or punch and sledge, or by the use of an air hammer or rivet buster; then break the staybolts down with a staybolt breaker or leave them in the old fire-box sheets, dropping the sheets or pieces of sheets on the floor. After this has been done all stay and crown bolt burs can be cut or burned out of the holes.

All necessary repairs to the cylindrical parts as well as the fire-box sheets are made and sheets cleaned while the new fire-boxes are being fitted up, riveted and caulked, and then the boxes are ready to be applied.

It is not necessary to remove the back head or disconnect the boiler at throat sheet to apply wide fire-boxes; neither is it necessary to remove any boiler braces, except the braces applied to the back flue sheets. If the boilers are on the floor and crane service is available the boiler can be turned over in any desired position. This is a very great advantage in making this class of repairs as it will make the work much easier, and in our opinion is a much quicker and handier method for doing this work.

In applying these fire-boxes your committee differs some as to the manner in which this work should be done. In some localities they apply the sheets one at a time, and bolt them up inside of the fire-box casing. Where the fire-boxes are applied in this manner, the rivet holes are all countersunk and rivets driven on the inside of the fire-box by the use of air hammers. It is claimed that where

fire-boxes are applied and rivets driven by this method, the flanges of the sheets are protected, and there will be less trouble on account of sheets cracking out at the rivet holes. At some shops all fire-boxes are applied in this manner, while at others they are applied to only certain classes of locomotives. As a general proposition it is the opinion of a great number of men doing a great amount of this particular class of work, that the boiler should be removed from the frames and taken to the boiler shop proper. When this is done the fire-boxes should be fitted up, riveted, chipped and caulked, both inside and outside, ready to be put into the casing by the time the boiler has been cleaned and repairs made to the barrel and outside fire-box casing sheets, or new sheets applied if necessary. The fire-box can then be put in place if cranes are available. This can be done by turning the boiler with the opening of the mud-ring up and puting the fire-box in place by the above mentioned methods. After this is done and the fire-box is bolted in place, the boiler is let down on the floor and the fire-box door ring is riveted, usually by driving hammered rivets. In some instances they are welded. The mud ring is then put in place and riveted with a mud-ring riveting machine or air hammer, and then chipped and caulked, the roof and staybolts being applied in the usual manner. All staybolts are driven with an air hammer or staybolt driving machine, and should be held on with an air holding tool, after which, the flues are applied. In removing and applying fire-boxes in this manner, by taking the boiler off the cylinders and the frame, the machinery can be taken to the machine shop and repairs made, while the boilers are being repaired and new fire-boxes being applied.

The frames can be taken out of the erecting shop and placed on the outside. In that event they will not be taking up any room in the erecting shop while repairs are being made to the boiler. The space in the erecting shop can be utilized for repairing other engines during this time. When the boiler is nearng completion the erecting shop foreman can be notified, giving him the date the boiler will be finished, and he in turn can bring in his frames and there will be no delay whatever; he can then proceed to erect and complete his engine.

The committee does not think it advisable to cut the back head out or disconnect the boiler at the throat sheet at any time to remove any wide type fire-boxes. This is an unnecessary expense as well as it will destroy a good tight seam or joint. It is liable to cause fractures and cracks in your flanges and plates by the driving cut of rivets that are in these seams. If these rivets had never been disturbed, the defects as given above may never develop. Any wide type fire-boxes can be removed and applied without disconnecting the boiler at throat sheet, or cutting out the back head, by one or the other of the methods set out in this report for doing this work—by applying the boxes after they have been riveted together, or by putting in one sheet at a time and riveting all inside of the boiler. The only objection that might possibly be found with the latter method is that you may not get your iron up tight on the water side, and it is not possible to caulk the sheets.

In the opinion of the committee, when boilers are removed from the frames, the fire-boxes should be riveted, chipped, caulked and completed before being inserted into the casing. It is also the opinion of the committee, that, either one of the above mentioned methods for the removing and replacing of wide type fire-boxes

would be the most economical method of performing this particular class of work.

B. T. SARVER, Chairman
A. N. LUCAS
BERNARD WULLE
Committee

THE PRESIDENT: As Mr. Sarver is not here, I will call upon Mr. Lucas.

MR. A. N. LUCAS: This is not very much of a subject. We all ought to know how to take out a firebox and which is the best method. Mr. Sarver, the chairman of the committee, is not here. So I am going to say a few words for him. A great many roads take out the back head and cut the boiler in two at the throat sheet, breaking the staybolts with a staybolt breaker. We have abandoned that some five or six years ago, or probably longer. We drill all the staybolts, and then knock out the flues, cut off the rivet heads in the mudring, and back them out. We then put the acetylene cutter to work and cut the back flue sheet in two and drop it. We cut the radial staybolts off on the bottom and the top and break down; then we cut the crown sheet and drop it, cut the back end and then cut the door sheet loose. After this work is done we use the staybolt breaker, a home-made tool. It has a sharp punch and fits the drill hole. With two blows we ca nbreak the bolt. On the narrow firebox we take out the side sheet and the remainder of the door sheet. We rivet it inside, not cutting the boiler in two or at the throat or taking out the back head. If back head is cut out all the braces have to be removed and the rivets knocked out. Many times the sheet has to be cracked out at the rivet hole. The same thing will happen where the boiler is severed at the throat sheet. Where job is a good one riveting can be done. Some of the methods may cost a few dollars more, but I believe we can save money with our method. I could give you some of the prices on that work, but it would vary with the different roads. They have different methods and I would like to hear from other members on this subject.

THE PRESIDENT: I would like to hear from Martin J. Guiry. He has a big shop and I would like to have him tell us how he is doing that work.

MR. GUIRY: We disconnect at the cylinder. We found by doing so you can turn your box upside down and break the stay bolts with the staybolt breaker. I think it saves time and money. Of course, it depends a good deal on the shop. Some shops have overhead cranes and they can handle the locomotive—turn it upside down—and I think in that case it is better to have it disconnected at the cylinder and the boiler can be

turned in any way you please; but where the engine is left on the frame we find it more economical to cut it off at the connection and let the frame go back to the machine shop. As to taking them out piece by piece and putting them back in the same way, we have never tried it.

THE PRESIDENT: Do you burn the firebox out?

MR. GUIRY: We do it altogether; we don't burn the staybolts, we drill them.

THE CHAIRMIN: Do you burn the sheet and break the staybolts?

MR. GUIRY: We break them and lift the back end off, if it is not taken out of the frame. We never tried the other method. I don't know anything about it.

THE PRESIDENT: I want to call on the gentleman from Columbus; he has not said a word.

MR. FRED BAYER: I am a poor talker, but I will endeavor to say a few words. We renew about three of the wide fireboxes weekly. We drill the bolts from the outside, take a hammer with a punch and knock off the bolts. Before doing so we cut the sheet loose inside of the firebox with acetylene, take the flue sheet out, cutting up the knuckle of the flange and through the flue holes and all the way around the sides and door sheet. Then the boiler is laid on its side and the bolts cracked off with a hammer, removing one sheet at a time. We turn the boiler for every operation except door and flue sheets. We have a crane and it is a very small matter to turn the boiler. After the firebox is taken out we examine the back end of the boiler to see if everything is in good condition. We build the firebox on the floor, rivet it up and place the firebox in the outside shell. Sometimes the boiler is upside down. If so we just put it in that way. It depends on how the cranes serve. We put the firebox in and fasten it and turn the boiler back. I believe that is one of the most economical ways of applying the firebox. One of the gentlemen said that he cuts the staybolts off with acetylene. I would like to ask whether he cuts the staybolts off on the water side or whether he cuts around each bolt on the firebox side. I have tried cutting off staybolts with acetylene and find it very difficult practice as the scale on the bolts stops the cutting process. The scale must be knocked off to a certain extent to do the job right and fast, and as the acetylene is expensive, I find it cheaper to break off the bolts the other way. I thank you for your attention.

MR. D. A. LUCAS: The best method of removing the firebox is the cheapest, the one that gives results. We take off the cylinder and it

is cheaper to take the bolts out of the cylinder than it is to cut the connection. The boiler is taken to the boiler shop and all the stay bolts and radials drilled. If the engine has an installation of flexible bolts, we drill them on the inside and knock them off. If it has rigid bolts we drill them and the stays on the outside, cut off the heads of the mudring rivets and knock them off. If the acetylene burner is handy it is a good thing to burn the flue sheet and the door sheet in half and quarter the crown sheet; burn through the center lengthwise and then across in the center sideways. After the bolts are drilled we lay the boiler on its side; break the staybolts four or five at a time, break down the radials and leave them in the crown sheet, the radials and crown stays being removed from the crown sheet by a helper and apprentice, who take an air hammer and nick and break off the stays, after the crown sheet is out on the floor. This can be done very cheaply. I can give you the cost.

MR. SMYTHE: We do not all have the same advantages. If prices are quoted they go into the proceedings, the superintendents of motive power see them and want to know how it is that one man is doing work so much cheaper. I, therefore, move that no prices be quoted. Carried.

MR. STEWART: Our practice of removing wide fireboxes on the Atlantic Coast Line is to remove the boiler from the frames and send it to the boiler shop. We burn out the old box in pieces of 36 inches x 48 inches for station gang boards. We then take the welded firebox from stock, several of which we build at a time on shop order, and apply the box, put in mudring and staybolts, and drive mudring rivets and staybolts. The boiler is then returned to the frames. In the meantime we put in radials, flues and arch pipes. By this method machinists and boilermakers finish up about the same time. This is also a very quick method.

THE PRESIDENT: How do you drive the staybolts?

MR. STEWART: With a long stroke hammer. Our method of putting in narrow boxes is to burn out the box in the same manner as the wide boxes, but we do not remove the frames or the mudring, nor cut out the back head or disturb any of the boiler braces. We apply the box in five pieces, put in the staybolts, and weld the box complete, after which we drive the mudring rivets and staybolts. By this operation there is a saving of nearly one-half over the old method of removing frames, mudring, back head and braces, and riveting the boxes.

MR. WESTOVER: Do you weld the flange?

MR. STEWART: Sure, we weld the firebox complete. We have no rivets except on the mudring on either the wide or the narrow box.

MR. FRED BAYER: I would like to say a few words in regard to narrow fireboxes. We remove all of them from the frame because nearly all are old type locomotives, and we find more or less work on the barrel and also the front flue sheets. They are cut off at the throat sheet connections; on some other classes we cut out the backheads. It all depends on the class of engine. The outside sheet or backhead is seldom found in good condition, or the throat sheet. With the exception of very few we have to apply the half throat sheet or the backhead and therefore we believe it is good practice to cut the boiler from the frames. Of course, it depends on the facilities of the shop. If there is no crane to handle the boiler and the work on the boiler has to be done while it is on the frame, it is all very well to try to do the work on the frame, but it takes up time and space in the shop; but when the boiler is taken off the frame and removed to the boiler shop, while it is undergoing repairs, the frames and machinery are put in shape, another boiler is being stripped—one is being constantly stripped. After the firebox has been applied the flues are in place in the boiler which is then taken to the erecting shop and the men can go right on with their work. We have a system and it works out very well. I thank you.

MR. A. N. LUCAS: I was talking for the benefit of the members who are in the same boat that I am. I am not discussing the subject for the benefit of the members who have a modern shop with overhead cranes. A great many of us have an ordinary shop where they still have to do the same job in the same old way. We have no overhead crane. We don't take it off the frame. We have to do the best we can with the facilities we have. In applying the firebox piecemeal, we don't disturb the mudring or take out the collar plug. If the metal is eaten away at the mudring we build it up with the acetylene burner. We can weld it up in good shape. If we had a hydraulic plant and an overhead crane the engine could be lifted off the cylinder when it came in for superheater flues and the frame sent to the back shop. We have a modern riveter which we have been using for the past four or five years. We rivet the mudring and the backhead and sometimes the back end of the mudring is riveted without removing the frame. We feel that our practice is first class in consideration of what we have to work with; where you have a modern equipped shop, it is a different proposition.

MR. WESTOVER: In removing our wide firebox, consolidated type, we have extra back ends. We cut the back ends loose at the connection, including the throat sheet, cutting the flues loose in front and back flue sheet, removing the back end, with flues still in the boiler. After the back end is removed, the flues are removed from the boiler and new back end applied, holes seamed, boiler scaled and throat stay applied, flues applied and ready for water in 54 to 60 hours. All the work is done by pneumatic tools. We remove all mudrings when fire-

boxes are applied to anneal corners and make inspection for cranks. We have cranes for handling this heavy class of work, which is a large factor.

MR. C. W. SHAFFER: I believe the question before the convention at the present time is one for the individual to decide; it is a matter for each railroad to determine, as we are all working under different shop conditions with a variation of tools. Recently the general office of the Illinois Central sent out lists of boiler repairs which are performed when engines receive heavy repairs. This report is kept by each boiler foreman on the system, who checks off work performed and gives cost of same, returning the report when all work is completed on each engine. It is then checked by the general office, who compare reports, see the best results and instruct accordingly.

On motion of Mr. Madden the discussion was closed.

THE PRESIDENT: The next subject on the program is, "What is the Advantage of Cutting Off the Stay Ends With the Oxy-acetylene Over the Old Method of Nippers and Chisel?" Thomas Lewis, Chairman; L. Borneman and William G. Bower, committee.

REPORT OF COMMITTEE ON

"What Is the Advantage of Cutting Off Staybolt Ends with the Oxy-Acetylene Over the Old Methods of Nippers and Chisels?"

In handling the above subject, let us first consider the objections to the use of the nippers. In nipping off staybolts ⅞ inches or 1⅛ inches, or 1 inch diameter, the damage is not so great as in nipping off 1⅛ inches or 1⅛ inches diameter.

It always occurred to me that the threads on the staybolts or on the sheet were unduly strained, also leaving the end of the staybolt with two long corners, making them more difficult to rivet over.

In the use of the chisel bar and sledge, it is simply 50 per cent worse than the nippers in the amount of damage done to the threads on the sheet and staybolt.

Many good shops have the length of the bolts taken and the bolts nicked to length before the application of the staybolts to the boiler. There are no objections to this method, only, at times, it so happens after the bolts are applied and the stub ends are broken off, we have found that the bolts are not of a uniform length.

The advantage of cutting ends of staybolts off with the oxy-acetylene, are:

First—The bolts are not disturbed after they are once applied.

Second—We get a uniform length to drive without long corners.

Third—The heat anneals the end of the staybolt which is a great advantage in the riveting, as the operator is better able to do a good job in upsetting the bolt without leaving any ragged edges, and as all staybolts are applied from the fire side of the fire-box, this is a great advantage where a first-class job is desired. Some may think that by cutting off stay bolts in this manner the heat penetrates through the bolt to the firebox sheet, but this is not so, as the operation of cutting is done so quickly the heat does not have time to reach the sheet.

Respectfully submitted,
THOMAS LEWIS, Chairman
W. G. BOWER

MINORITY REPORT

St. Paul, Minn., December 22nd, 1915.

Mr. Thomas Lewis, Chairman, Sayre, Pa.

Dear Sir:

Your letter and report of the 25th ult., at hand and contents noted. In reading over your report on "What is the Advantage of Cutting off Staybolt Ends with Oxy-Acetylene Over the Old Method of Nippers and Chisel," I am very sorry to say that my views do not coincide with yours, as shown by your report and it would not be advisable for me to sign the report.

In handling the above subject I have been unable up to the present time to cut very many staybolts off with Oxy-Acetylene, but I have cut off a sufficient number of ends to prove, I think, that we cannot cut them off as cheaply as we can with the staybolt nippers we have for doing this work. One half hour is all the time it requires for cutting one side of our largest types of engines which are the Mikado type. Our nippers are hung from the Crane and the bolts are cut off as fast as the machine can be transferred from one bolt to another. We have the Helwig Staybolt Nipper in two sizes, one machine for small bolts and one for larger bolts such as radial stays. These machines do good work. We have one man rated at 26½ cents an hour who handles these machines exclusively with a helper receiving 23½ cents per hour.

I note in cutting the bolts with Oxy-Acetylene the sheet gets so hot that it is impossible to place the hand on it in some places.

Have not gone into this work far enough to know whether or not the heat from cutting the bolts off in this manner will damage the sheets or bolts, but I do think that it is more expensive than using the nippers. It may be recommended as inexpensive on general repairs to use Oxy-Acetylene in cutting off a number of bolts scattered on the boiler and as preferable to using a chisel bar. We have at present but two Oxy-Acetylene outfits in our boiler department but have recently put in Prestolite outfits and I have no doubt but what bolts scattered in the boiler can be cut off cheaper with Acetylene.

Referring to application of bolts from the inside sheet out: I would not recommend this, as it is my practice to tap all holes from the outer sheet inward and apply the bolts the same way. In tapping out a staybolt hole with a motor, the vibration of the motor hanging with the weight attached from a pulley has a tendency to increase the size of the hole where first entered. The hole in second sheet as a rule is of the original size of the tap. When entering the

bolt, it will always be noted that it will not be as tight in the hole that the tap was first entered in as in the second hole; thus you are able always to get a good tight bolt on the inner sheet where it is absolutely necessary in order to prevent leaky staybolts.

Yours truly

L. BORNEMAN
Foreman Boiler Maker

MR. LEWIS: This subject I think is the same as the one we have just finished. It is something which must be determined by the individual shop. I was asked to write something in connection with this subject and in the report I have merely stated what we are doing in our shop, and why. We are equipped from one end to the other with the acetylene process and we find that we cut the bolts off more economically than we could with the chisel or the nippers. We find also that this method gives us better results than the old way. I have heard different men speak on this subject. Some of them think that by burning off the end of the bolt that we heat the staybolt, and they do not approve of any heat going into the staybolt. I think the manner in which it was done had a great deal to do with that. It is often done so quickly that the heat has no time to penetrate the bolt for any distance. We have adopted this method of cutting off instead of the old because we think it is the best and the cheapest.

THE PRESIDENT: Which is the cheapest?

MR. LEWIS: Well, when you compare the two, when you go into the cost of this, you have to take into consideration that when you use the chisel it had to be dressed, etc. So we think that this is cheaper for us; it may not be cheaper for some others, but in our shop, as I say, where we are equipped so efficiently for doing the work, we consider it the cheapest and best method.

MR. WANDBERG: I will agree with the gentleman who preceded me providing the bolts are put in from the inside, and for cutting off radials or under the throat sheet, or in difficult places, it is all right, but as far as being cheaper on straight work, on bolts applied from the outside, I don't believe there is any method cheaper than the nipper. I have heard some people say that you can't do a good job with a nipper; if that is so, get your nipper dressed, they are not made right. Now I don't believe there is any method cheaper than compressed air, if your nippers are right; that is my experience, I am speaking of bolts applied from the outside. I cut all the radils with acetylene, as well as the bolts under the throat sheet or any applied from the inside, but I believe it is far cheaper on straight work to use the nippers, that is the cheapest way of getting them off.

MR. ROBERT GIBSON: This staybolt question is a little new to me. My experience of former years was with a hammer and chisel; then we had

the air hammer. The latest improvement to-day is burning them off, but I think it softens the material, although I do not feel that this hurts any, and I believe it is the best and cheapest method. I think the softening of the material is really beneficial.

MR. C. R. BENNETT: Some of the members have said that they cut off all their staybolts with acetylene gas; that the method leaves the bolt in a very soft condition and easy to be hammered up. We used acetylene gas to cut off staybolts for a while, but we discontinued the practice as we found the staybolts loose in the sheet. The bolts were hardened and hard to hammer up. If any of you will tell me the cause for this and how to overcome it, I will appreciate it very much.

MR. LEWIS: You want to get another operator, Charlie.

MR. STEWART: Burning the bolts off with acetylene is undoubtedly the most economical way. When you use the nipper you do not get them nice and square as you do with the acetylene. We have no trouble in driving the bolts after they have been burned off and I think it is the most economical way. We find it is really the most practical way.

MR. C. R. BENNETT: How can you detect whether you should get another operator or not? Gentlemen, I came here to get information; to learn how we can do better work. Advising me to get another operator does not solve the problem. It is up to me to educate the operator, no matter who he is. We take a man out of the shop and furnish him with an acetylene tank and hose and start him to work, and the boiler maker foreman must get a good job done by this man. So I would like to find out if I can why we were not successful in using acetylene gas for cutting off our staybolts. I feel that each one of us should get up any say what we are doing at our home shops; and endeavor to give the information in a clear way so that it will be of the greatest help to those who need it most. That is my idea of the purpose of this Association and of these conventions. Then when we find ourselves puzzled over some work that does not turn out as we had anticipated we can refer to the proceedings of the convention and hope to get some helpful information therefrom.

MR. STEWART: You will have to get the right pressure, the right amount of oxygen, and we find that the quicker they are burned off the better. We use 60 pounds up to one inch butts and 80 pounds for larger bolts.

THE CHAIRMAN: Can you tell by the flame?

MR. STEWART: Yes, the thread of the bolt. It seems to make the flame take hold, and the bolt goes off immediately. You must first get your

flame right and the only way to do this is by watching and experimenting. Then you will not get the hardness of which you complain. We get them just as soft as can be.

MR. BENNETT: What recess do you make, what opening?

MR. STEWART: Very little. We take the tip and bend it, and just let the head of the torch rest against the sheet. That makes a steady rest and will cut your bolt to two threads and a half, or whatever you want for the head, and blow it right off.

MR. D. A. LUCAS: According to my experience hardening on the welding, or in cutting stay bolts, is due to the operator using too much oxygen. Pressure should be as small as possible to get results in burning.

MR. C. R. BENNETT: When we employ a man I assist him in every way that I can to make a good workman and to help him to understand anything with which he is not familiar. When I find I am a little stale on some subject which comes up in practice, I refer to the proceedings of the last convention of the Master Boiler Makers' Association and read up whatever there is on the subject. I also get the others to do so and after we talk the matter over we try again, feeling that what we have read will be of help to us; but if we are going to allow ourselves to come here and not say anything I cannot see that this meeting will be of very much good; and it seems to me that our next book will be a very poor book for reference.

MR. LEWIS: Mr. Bennett, we get results contrary to yours. You say that you find a hardness in the bolts. It is just the contrary with us. Our bolts anneal, and the cause is that the operator is there too long on the bolts. The whole secret of this acetylene work, I might say 90 per cent. of it, is due to the handling of the torch. You can't go to this man and that man, put a torch in his hand and tell him to go and operate it and get successful results. It took us a long time to bring our men to their present perfection. We have had it more than three years. At first we had a little portable machine and it took us months to train a first-class boiler maker to know how to handle it. We kept on and watched our men. When we got a man who was pretty good, we made him foreman of the job. It is his duty to go around to the men and see that they do the work right. When we first put a man on the job we give him the crudest kind of an operation to perform, probably cutting a piece of iron. He works on that until we consider him competent to be put on something better, and probably it would be a year before we would put a man on welding. You can't pick out any man and expect him to do the work properly in a day. You have to educate him, and I think the cause of

our friend, Mr. Bennett, getting hardness in the stay bolts is the man burning them for a minute when he ought to cut them off in a second.

MR. A. N. LUCAS: In our previous discussion on oxy-acetylene welding, we demonstrated the benefits of acetylene.

THE PRESIDENT: One of the advantages and benefits of oxy-acetylene is in cutting off the staybolts. When you hammer them you will find that they are ragged and then if you go inside and cut them off with the acetylene you will see that they look like lead; there is not a crack in them. I certainly think cutting off the staybolts with a burner is a benefit.

MR. BORNEMAN: In using oxy-acetylene for cutting off staybolts, we have found that the sheets get very hot. We use the brass staybolt bushing for reducing the size of the staybolt. One inch diameter of staybolt is our limit on new work. Therefore, I fear the heat would injure the bushings. We use the Helwig staybolt nipper for cutting off staybolts and with a little experience most any helper can cut them off as quickly as the machine can be passed from one bolt to the other.

On motion of Mr. Madden the discussion was closed, the committee being complemented on its report and discharged.

THE PRESIDENT: The next subject on our program is, "Which Firebox Steel Gives the Best Results in Locomotive Service—the Basic or the Acid?" James C. Clark, Chairman.

REPORT OF COMMITTEE ON
"Basic Versus Acid Steel for Fire Boxes."

Your committee appointed to make a report on "Basic versus Acid Steel for Fire Box Use," hereby submit the following:

Acid open hearth steel may be distinguished from basic open hearth steel by its being normally higher in silicon, and usually in phosphorus, but lower in manganese.

ACID OPEN HEARTH PROCESS

The acid open hearth furnace is heated by burning within it heated gas and air, each of which has been previously preheated before it enters the combustion chamber. The metal lies in a shallow pool on a long hearth which is lined with siliceous material, and is heated by radiation of the intense flame. The impurities are oxidized by slag lying on top of the metal. The action is so slow, however, that the carbon in the pig iron takes a long time for combustion. The operation is therefore, hastened in two ways: (a) iron ore is added to the bath; and (b) the carbon is diluted by adding with the furnace charge large proportions of steel scrap, often as much as 75 or 90 per cent. It takes from six to ten hours to purify a charge. The manganese and silicon go into the slag first,

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then the carbon boils off as a gas. When this has proceeded to the desired point, the bath is recarburized and the metal is cast into ingots. The characteristics of the acid open hearth process are:

(a) A long time in purification.

(b) Large charges are treated in the furnaces, the modern practice being usually fifteen to one hundred tons to a furnace.

(c) At least a part of the charge is melted in the purification furnace, and

(d) The furnace is heated with preheated gas and air.

BASIC OPEN HEARTH PROCESS.

The basic open hearth process is similar to the acid open hearth process, with the difference that a sufficient amount of lime is added to the bath to form a basic slag. This slag will dissolve all the phosphorus which is oxidized, which an acid slag will not do. The characteristics of the basic open hearth process are the same as those of the acid open hearth process, with the addition of

(e) Lime is added to produce a basic slag.

(f) The hearth is lined with basic instead of siliceous material, in order that it may not be eaten away by this slag, and

(g) Impure iron and scrap may be used, because phosphorus, and, to a limited extent sulphur can be removed in th operation.

COMPARISON OF PURIFICATION PROCESSES

Acid vs. Basic Open Hearth.

Acid open hearth steel is believed by engineers to be better than basic, and is usually specified for all important structures, although not so rigidly today as a few years ago. This is in spite of the fact, that phosphorus and sulphur, two very harmful elements, are lower in basic steel.

The basic process is less expensive than the acid, because high phosphorus pig iron and scrap are cheap, and the lower cost of materials used more than balance the greater cost of the basic lining, and lime additions, and the circumstance that the acid furnace has a higher output because heats are shorter. Acid steel is preferred by many, however, for the following reasons:

(a) A basic slag will dissolve silicon from the metal; therefore, the recarburizer is added to the steel in the basic process after the steel has left the furnace, instead of in the furnace, as in the acid process. Should any basic slag be carried over with the metal, however, which is liable to happen, there is the danger that the ingots will be too low in silicon. They are then impregnated with gas bubbles or "blow holes." Indeed, the last part of a heat of basic steel teemed from a ladle will be lower in silicon and manganese, and higher in phosphorus and sulphur, as already indicated in discussing the basic process. A goodly portion of the acid open hearth steel goes into steel castings, where the presence of blow holes would be injurious.

(b) Moreover, the recarburizer does not mix with the steel as well, if it is not added in the furnace, because of the stirring in pouring.

(c) A basic slag is more highly oxidized than an acid slag: therefore, the metal at the end of the operation is more highly charged with oxygen. For this reason a larger amount of manganese is added

in the recarburizer, but the remedy is never quite as good as prevention.

(d) Since the phosphorus cannot be removed from the bath in the acid process, it is necessary to use only selected iron and scrap; whereas, in the basic process, good steel can be made from any quality of material. Many engineers believe, however, that a better grade of steel results from the use of selected materials.

(e) It occasionally happens in the basic process, after the phosphorus has all been oxidized in the slag and the operation is ended, a good deal may get back into the metal again. This is especially liable to happen when basic slag is carried over into the ladle before the recarburizer is all in. If this occurs, and if the bath is very hot, a reaction may take place between the basic slag and the acid lining of the ladle. In this way the slag will be enriched in silica, and phosphorus will be forced out of it into the metal.

For the layman to state which process will make the better boiler steel, is an impossibility. It is necessary that one should have some practical and scientific knowledge of the processes to determine which is the better.

Respectfully submitted,

J. C. CLARK, Chairman.

H. J. RAPS

Committee

MR. MADDEN: This subject came up before the convention at Chicago and at that time several suggestions were made to have it referred to our mechanical engineers or chemists, as there seems to be no one in the Association who is familiar with it. I move the subject be closed. The motion was carried.

THE PRESIDENT: We have with us to-day, Mr. Edward J. Geoghegan, of the Superno Company, and I will call on him to make a few remarks.

MR. GEOGHEGAN: I know that you are more interested in the maintenance o the large fire tube that carries the superheater than you are in the matter of the lubrication of the cylinders of superheated engines. I understand that is the case. I take that for granted. It has been thought that it was the temperature to which steam is superheated which affected the steam and which caused difficulty in maintaining efficient lubrication. Now we have proved that the temperature has nothing at all to do with it; it is the method of attaining the temperature. As you are no doubt aware the drop in steam pressure through the superheater is sometimes 30 to 50 pounds, so therefore the superheat is attained partly by "wire drawing" which results in chemical change of the steam. It has been proved conclusively that cast iron increases in tensile strength up to a temperature of 800 degrees. That fact has been established and I know that in some superheaters of the "flash" type the cast iron fittings have had to be replaced by steel. I don't know how far this applies to loco-

motive practice, but in stationary boilers the majority of insurance companies insist on cast iron fittings being replaced by steel fittings. Prof. Luckovitch, of the Standard Oil Company, has established the fact that mineral oils do not undergo chemical change due to temperature, under 750 degrees Fahr. Now the ordinary locomotive superheater very seldom attains a temperature of over 650 degrees—sometimes not as much as that—and it follows, therefore, that lubricating troubles are due to the types of superheaters used rather than to the temperature to which the steam is superheated.

We have applied Superno superheaters to stationary boilers up to 2500 H. P., delivering steam superheated to 750 degrees Fahr., to practically every type of reciprocating engine, using exactly the same quality of cylinder lubricants as formerly was used with saturated steam; the lubrication is not a bit more difficult and it only takes about half the quantity of cylinder lubricants formerly used to do the work now.

We have not attempted to apply this superheater to locomotives yet, but we very soon will.

I would be very glad if some of the members who have had experience in maintaining superheaters would ask some questions. I have gathered from the discussion that you are more interested in the maintenance of the large tubes, than in the superheaters themselves.

MR. KNAUER: I have been a boiler maker for some time and I would like to ask about the collapsing of the tubes. I don't mean the large tubes, but of the superheater tubes themselves; the units collapsing.

MR. GEOGHEGAN: That would be all right. You don't have to replace them in our system. Your tubes collapse because of the steam being chemically changed during the superheating.

MR. D. A. LUCAS: Has anybody experienced any trouble with the superheater tubes filling up with a formation and burning and giving out for two or three feet?

MR. GEOGHEGAN: That is caused by a chemical change that is supposed by engineers to be caused by the temperature to which steam is superheated, but it is caused by a chemical change which takes place when the steam is too rapidly raised from temperature of saturation (say 378 degrees Fahr., at 180 lbs., guage pressure), to say superheated temperature of 642 degrees Fahr.

MR. LEWIS: Do you mean that the steam is generated too fast in the boiler?

MR. GEOGHEGAN: No, but that the temperature is increased too rapidly. It is "flashed," and you know yourself that in the "flash"

method of superheating the velocity of the steam through superheater causes you to have a drop in pressure of from 30 to 50 pounds, which should not occur. I thank you, gentlemen, for your attention.

REPORT OF THE COMMITTEE ON

"Cracking of Barrel Sheets, Where They Crack as Well as the Shape of the Crack."

After giving this subject considerable attention, your committee decided that in order to report on it more intelligently we should take the matter up with several members of the Association who have had considerable experience along these lines and who have charge of some of the largest shops, well separated throughout the country geographically, and ask them to give their opinion on a few questions relative thereto. It is regretted, however, that only about 10 per cent of the members addressed answered the committee.

Barrel sheets are likely to crack in any part of the boiler, but occur most frequently in the lower part of the boiler. Cracks occur in the lower part of the boiler at the girth seams, usually running in girth seam direction. This is caused by the barrel sheets becoming inefficient, owing to pitting or corrosion, or to the girth seam leaking.

Cracks also occur on the lower half of boiler where frame braces or tee irons are riveted or studded to the barrel sheets. The sheets generally crack at the end of the tee iron or angle irons, the crack running lengthwise of the boiler; but the cracks found at this part of the boiler are likely to be found extending in most any direction, according to the cause. We believe the cracks found here are due primarily to bad condition of machinery, such as bad pounds or broken frame, causing undue strain upon the barrel sheets at these points.

Cracks occur at the longitudinal butt joint seams between the rivet holes, in a longitudinal direction, or at edge of outside welt strap, in a longitudinal direction. The cause for these cracks are either due to improper design of the boiler, bad workmanship, or possibly poor material. However, we believe that practically all of this is due to bad workmanship. Either the sheets have not been properly rolled or the rivet holes have not been drilled and carefully reamed.

Cracks also occur where washout-plates are applied to the bottom of the boiler. Such cracks generally begin at the edge of the washout hole made in the barrel sheet and extend outward in any direction. This is caused by decreasing the strength of the sheet in cutting away the washout hole.

The only way we know of to prevent cracking at the bottom of boiler at girth seams is to keep the bottom of the boiler clean and free from the impurities which cause pitting and corrosion.

Cracking of barrel sheets where frame braces and tee irons are riveted or studded to the sheets can be overcome to some extent by applying re-inforcing plates of proper thickness and design to the inside and the outside of the boiler where the braces or tee irons are located.

Cracking at the longitudinal butt joint seams can be overcome by greater care in rolling the barrel sheets and properly drilling and reaming the rivet holes.

Cracking at washout plates can be overcome by applying reinforcing plates on the inside and outside of barrel sheets where the washout plates are applied.

C. R. BENNETT, Chairman
C. N. NAU
JOSEPH McALLISTER
Committee

MR. C. R. BENNETT: When I was informed that I was chairman of this subject, I sent out 24 or 25 letters to boiler maker foremen, who represented large shops—the largest in the United States, as well as Canada. I received only five or six replies. The information given me and what I had myself constitutes this statement. I feel that it is not correct, as it ought to be made. I think it is a matter that should be brought before the house.

MR. A. N. LUCAS: In looking over this report you will note the committee states: "We believe the cracks found here are due primarily to bad condition of machinery, such as bad pounds or broken frames, causing undue stress upon the barrel sheets at these points." I believe that is right. It also says that the cause is due to pitting and corrosion, or to the girth seams leaking. We are not here to discuss the boiler when it is cracked through. We want to know what cracks the boiler shell; that, I believe, is the subject. We have all classes of cracks. On our 60-inch switch engine that sets up high in the saddle the first indication is leaking under the jacket. Investigation shows that a rivet head is off. Later we find a cracked out rivet hole in the girth seam and then it cracks down through. I believe that is caused by constant jamming up against a heavy load. That humps the boiler and the shell is not strong enough to overcome it. We have the same condition on the Prairie type engine. On the Pacific type, where the yoke brace is bolted to the angle on the side of the shell, we must have the reinforcements. When we find these conditions I believe we must strengthen up; in the middle of the shell there is too much of a load on a Mallet type. I think the load comes sometimes on the center casting and it raises the bottom of the shell, which is not strong enough.

MR. CONRATH: Has a motion been made that the subject be opened for discussion?

THE PRESIDENT: That is not necessary.

MR. YOUNG: Another cause of cracks in the barrel of a boiler is that when the longitudinal seams are not brought to a true circle, or in other words are flat when the pressure is put on, the barrel goes to a true circle, and when it is released it returns to its original position. This working

at the joint you will find in time will cause a crack at the inner edge, especially of a lap joint.

MR. ROY WELSH: My experience with cracking on the grooves of the boiler shell and pitting is as follows: I find that the pitting might be due largely to water conditions, but I think it is due to arrested expansion. The belt that supports the belly of the boiler expands and there should be pads to take care of the expansion and sometimes the pads are not properly lubricated and the engine can't move forward and backward when it is heated up. You will find that the belly seams are leaking, which is caused by the arrested expansion; you rarely find the boiler leaking on the bottom seams, only around the mudring and frame where they cannot move. I may not be right, but as I said, I think the cracks are due to arrested expansion.

MR. FRED BAYER: We have had some experience with the bands of the boiler cracking at the waist sheet, or at the outer edge of the "T" iron, on the large type engine. I think the trouble is largely due to expansion and contraction. The reason for this is that the "T" irons on a heavy type engine are very heavy, and when the shell of the boiler becomes heated, it expands the "T" iron rivets; these being heavy on the outside, they will keep cool while the boiler expands, and that has a tendency to pull against the "T" iron on the boiler. The result is vibration at the end of the "T" iron, up on the side of the boiler, where the last rivets are, and that is where we find the cracks. This, in my opinion, is the cause of cracks at that point.

THE PRESIDENT: Do you believe in riveting the "T" iron to the belly of the boiler?

MR. BAYER: I do not. I think that the "T" iron should not be riveted, but should be fitted up properly to the boiler, and a wearing plate applied on which the "T" iron may slide. I don't think that any bad results would follow. I have not seen any in service, although we have a few locomotives where the "T" irons are not fastened to the boiler. I would like to see my idea tried out, and in the convention next year, I think it should have attention. In the meantime I think it should be the subject of experiment, and if possible the results made known.

MR. CRITES: The point that the President just brought up is what I wished to talk about. The "T" iron is riveted to the bottom of the boiler and bolted to the frame, making it rigid. There is no chance for expansion and contraction. It causes loosening of the rivets and sometimes cracks the sheets. I would like to see the rivets left out and the boiler allowed to slide on the "T" iron. It will overcome the trouble, but may be riveted to the boiler and bolted to the frame to support the machinery.

MR. D. A. LUCAS: I have had some experience with the shells cracking. I think it a wrong thing to rivet the angle iron onto the shell. The support is put there for the purpose of supporting the boiler between the top of the frame and the extreme front end. If put up too rigid, when the engine goes over a high spot, the full weight of the engine is carried right on the boiler, and that is what causes the cracking at the end of the angle iron. One of our Mallet engines cracked 48 inches between the line of rivets. The rivets were 10 inches apart. I suggested that the casting in the center of the boiler, between the extreme back end and front end carried the whole weight of the engine and the shell was not strong enough to stand it, causing the squashing condition. After a certain amount was taken off the casting and the shell patched we had no more trouble. One other engine of the same class caused trouble because it leaked for 18 inches on the bottom of the shell. The first idea advanced was that the rivets were not properly driven, but the same man riveted them and made just as good a job on the bottom as on the side. Conditions caused the rivets to leak. So half of the casting was removed and a thinner lining was put on and we have had no more trouble. The application of pads is a very essential point. We have, at times, boiler failures in the seams and also flue failures, due to the fact that the boiler is hot, expands on top and is held on the bottom. It jumps five-eighths of an inch and breaks the caulking edge on the firth seams and causes trouble. If the expansion pads were well lubricated at all times it would eliminate the trouble to a big extent.

MR. POWERS: Instead of riveting the angle iron we applied a wearing pad at the end, the angle iron being left loose, and as the engines go into the shop we cut them all loose—we cut the angle iron loose so that they are free all over.

THE CHAIRMAN: Mr. Lewis, I would like to hear from you on the subject.

MR. LEWIS: Mr. Lucas brought up an important point, inasmuch as I have heard recently of the cracking of shells at the saddle castings of Mallet engines. If it is wrong to rivet the angle iron to the shell, that would give a very good explanation to me of the cracking on the shell at the saddle castings of the Mallets. So far as I understand the design of the Mallet it seems essential to support the saddle of the high pressure cylinder, which is about midway in the barrel of the boiler, through the shell, and I think that might be a point which it would be advantageous for us to recommend for these conditions to the Master Mechanics' Association, in view of the trouble of the maintenance of boiler shells with reference to the cracking stresses set up by the rocking of the Mallet on the high pressure saddle casting. I think where there is nothing of that

nature, where you are depending on the angle connection between the frame and boiler, omission of the rivets is very good practice.

MR. ARCHIE M. BAIRD: I would like to say a few words relative to cracks in the shells of locomotive and other boilers, and where they occur most frequently. In my experience I have found many causes for cracks in locomotive shells. We all know that everything under pressure has a tendency to arrive at a true circle. If the thickness of plate in the circumference of the shell were of equal thickness throughout, with no seams, and similar to the old style English boiler, made with welded joints, it would avoid most of the trouble with which we have to contend. Instead, however, we butt our seams, and place three thicknesses of plate to cover the butt, with welt straps inside and out, and applied so as to give the seam a strength as near as possible to the solid plate. Consequently, where these heavy welt straps are applied the pressure does not effect that portion, but the shell in rounding itself under pressure finds the weak point, which is directly over or under the edge of the weld strap, causing the circle to hinge at this point, and in time cracks will develop. To avoid cracks at this point, about 20 years ago, I applied a diamond shape welt plate. Each side of the welt was cone shaped, which took in nearly one-third the circumference of the shell. This method overcame a great deal of our trouble, and is known as the diamond welt seam.

There are other places on the shells of boilers where cracks are found when "T" irons, or brace brackets supporting the guides or frames are placed thereon. Cracks found in this instance are caused by vertical hammer blows, through the operation of the locomotive while in service. In replacing a "T" iron or steel bracket, it will often be found that the part of shell which they cover is badly worn, and sunk into the shell in some instances one-third the thickness of the plate, showing a print or duplicate of the bracket or the "T" irons. Cracks are often found closely allied with these braces and angles. A locomotive in operation has a continual succession of hammer blows on the shell of the boiler, wherever the machinery is attached thereon, and sooner or later this action is the cause of many cracks in locomotive boiler shells. It is hard to find a remedy while we continue the practice of tieing the shell to the machinery. Nearly all railroads are getting away from rigid bracing of the boiler to the engine, and are allowing the boiler to expand and contract with the least resistance possible.

MR. GRAY: I have had considerable experience with shells cracking. Some years ago it was the general practice to fasten the "T" or angle irons to the belly of boilers with studs. This did not prove satisfactory as there was more or less trouble with studs leaking and the shells cracking at the end of the "T" irons or angle iron. On some roads, at least, the studs were cut off and the "T" iron merely rested against the boiler.

A very general practice is to rivet a heavy section of angle to belly of boilers and attach the frame and guide yoke braces to them. This makes a more solid and satisfactory job than either of the other methods, but it does not eliminate the cracking or grooving of shells, as anything that causes a continual knocking on the shell makes it vibrate and opens the pores in the metal, allowing the impurities in the water to be forced into the minute openings by the pressure which is always present when the engine is working and vibrating the sheets. These impurities will soon destroy the fibers near the surface and others will be forced deeper until eventually we have a crack or a badly grooved or pitted section. This is proven by the fact that where feed water is good a cracked boiler shell is almost unknown. Boiler shells may crack from improper fitting up, poor material, etc., but in a great majority of cases I believe this to be the principal cause. The subject is very largely a technical and chemical proposition.

MR. YOUNG: You can look at this discussion from any angle and what does it all mean? Too rigid construction. What we need is flexibility. The man who can design a flexible boiler will eliminate this trouble.

MR. A. N. LUCAS: You mean the cracking of the shell and the stay-bolts is due to the same cause? I think it is the constant vibration—the contraction and expansion . I believe that where the boiler is cut loose from the saddle braces and allowed to be loose from the frame, it wears the bottom of the shell sheet. To overcome that you can put in a shim plate. I move the discussion be closed. Carried.

THE PRESIDENT: The next subject is, "What are the Best Rules to Follow in Arriving at the Maximum Heating Surface of a Locomotive Boiler?" Charles P. Patrick, Chairman.

In the absence of Mr. Patrick the report was read by Mr. Conrath.

REPORT OF COMMITTEE ON

"What are the Best Rules to Follow in Arriving at the Maximum Heating Surface of a Locomotive Boiler?"

Your committee on the above subject begs to report as follows:

All that part of a locomotive boiler exposed to the flame and hot gasses in which water is in contact, is termed heating surface, and the common rule to follow is as follows:

Take the side sheets from top of mud ring around across the crown sheet by the outside length of firebox, less draft tube openings. The door sheet, top of mud ring up, less the fire hole and arch tube openings. The back flue sheet top of mud ring up, less the outside area of tubes, also arch tube openings. The inside circumference of

arch tubes by the length. This is termed the firebox heating surface.

The flue heating surface is the circumference of the outside of the flues by the length between the front and back flue sheets.

It appears from information at hand, consideration is given the value of the heating surface of flues, in proportion to the length, and to be an accepted fact that the evaporating of water from the flue heating surface diminished as the flues get longer. It also appears that consideration is given to the width of the bridges of flue sheet, that is, one inch bridges being of greater value for evaporation than bridges of lesser width.

The design of the engine, in a measure, governs the size of the boiler, this being true the heating surface of the firebox being the most valuable, it is made as large as the limitations will permit. Following with the size and length of flues to meet as near as possible the conditions.

It is held (notwithstanding the diminishing value of the flue as it gets longer) that nothing is lost by using a long flue; on the other hand something is gained, since it is no harder to maintain, and absorbs in its length much of the heat which would be expelled out the stack.

CHARLES P. PATRICK
P. J. CONRATH
JOHN HOWE

MR. D. A. LUCAS: I move that the report of the committee be placed in the proceedings of the convention and the committee discharged. Carried.

MR. CONRATH: The practice of figuring the heating surface of a locomotive boiler, which I do not believe to be altogether correct, is to allow the full value of heating surface throughout the full length of the tube, where we all know that the value of the heat as it travels, diminishes. Therefore, if the full value is taken for the first 10 feet of the tube, you could not use that same value for the remainder because it diminishes as it travels on. It is my opinion that if full value was given, say for about eight to 10 feet, then about 50 per cent. for the next five feet, and for the remainder about 25 per cent., it would be nearer correct than using the full value of heat throughout the entire length of the tube.

Upon motion the discussion was closed.

THE PRESIDENT: The Secretary has some announcements to make.

THE SECRETARY: Jack Madden, Jr., has found a Shriner's scarf pin, which is now at the office of the cashier of the hotel to be identified and claimed by the owner. Mr. H. S. C. MacMillen, of the St. Paul, has sent this message to Mr. Wandberg:

"If the opportunity presents itself I think you should ask for discussion to determine whether excessive pitting is due to the action of static electricity or a chemical action of the water."

DRAFTAC

SPARK ARRESTER

FOR LOCOMOTIVE FRONT ENDS

The W. S. Tyler Company

CLEVELAND, OHIO

Mr. John Berry, of the Grand Trunk, makes the following suggestion: "In considering the subjects for the next annual convention I would like to see one hour set aside for questions that any member wishes to ask on any subject that is not included in the reports, all questions to be handed to the Secretary or sent to him by mail."

On motion a recess was taken until two o'clock.

AFTERNOON SESSION.

THE PRESIDENT: Gentlemen, you will please come to order. While we are waiting for other members to get in from lunch we will have a few words from Mr. Leslie R. Pyle, Fuel Supervisor of the Soo Line, who has a paper he wishes to read.

"THE RELATION OF THE EFFECTIVE AREA OF OPENING IN LOCOMOTIVE SPARK ARRESTER TO THE POWER DEVELOPED BY THE LOCOMOTIVE."

BY MR. LESLIE R. PYLE.

A few words at this time would not be out of place in regard to the relation of the effective area of opening in locomotive spark arrester to the power developed by the locomotive.

At first thought there may not seem to be an important relationship between the two; but this subject has been brought before a number of railways in such a manner as to bring out clearly that there is a direct relationship between the two.

The conservation commissions of some of the states are taking a deep interest in the question of locomotive front end netting with a view of limiting the size of opening in the netting which the railroads will be allowed to use. Their object is, of course, the selection of a size and shape of opening which will prevent the escape of dangerous sparks.

The railroads are also interested in reducing fire loss, but it is absolutely necessary from their standpoint that they be allowed to use a front end screen that will not choke or clog, and will at all times allow the engine ample draft for successful operation. Some of the states have asked for a netting specification that would work an extreme hardship on the railroads, for the mesh suggested would affect a great reduction of power developed by the locomotive, due to back pressure at the nozzle tip. One specification include 3 mesh .135 or No. 10 gauge. This screen has an effective area of only 35 per cent. and it is practically impossible to operate a locomotive with this size screen.

It is well known that the draft is a direct function of back pressure, and that any obstruction placed between the draft in front of the diaphragm and the firebox will cause a reduction in the draft produced with a certain amount of back pressure. The greater the obstruction, the greater will have to be the back pressure to supply the amount of draft needed. It might be mentioned that restrictions at the ash pan or through the grates will require a higher draft at the expense of back pressure than would be the case if there were a free opening under and through the fire.

It must be admitted that front end netting is an obstruction to the draft, and has to be considered as such. This being a fact the less we obstruct the draft with any kind of a spark arrester, the less will be the back pressure to supply the right amount of draft. In considering the opening through the spark arrester, we must remember that not only do we have to have draft enough to burn the required amount of coal to furnish steam to operate the locomotive, but from 3 to 20 per cent. of solid matter has to pass through the screen or we do not have a self-cleaning front end.

For a great many years the railroads have been working in various ways to stop the emission of live sparks from the front ends of locomotives and a great deal has been accomplished along this line.

Some of the states have also studied the proposition, drawing up specifications which the railroads were required to use, particularly on locomotives operating in Forest Reserves.

There is no question but that locomotives in the past have set fires along their rights of way, causing heavy damage bills which have been paid by the railroads; so that from an economical standpoint the railroads have studied this proposition and are more interested than anyone else in the successful solution of the live spark problem.

During this development period, a great many different types of spark arresters have been proposed and tested, and naturally there has been a vast difference between them in efficiency. The two types which are in general use at the present time are the square mesh netting and a netting with oblong opening known as "DRAFTAC Spark Arrester." Nearly all the states allow the use of a square mesh netting 2 1-2 mesh x 2 1-2 mesh No. 10 wire, or No. 393 DRAFTAC Spark Arrester. These being the two types in general use, it might be well to compare the effective opening in the screen and the size of the cinder which could pass through the screen.

2 1-2 mesh x 2 1-2 mesh .135 (No. 10) wire has an effective opening of 43 9-10 per cent. of the total area of the screen, with a width of opening of .265 inch, a little over 1-4 inch.

No. 393 DRAFTAC has an effective opening of 49 per cent. of the total area of the screen with a width of opening of only .188 inch or 3-16 inch.

From this it is plain that the DRAFTAC should and does not only give less obstruction to draft, but breaks up the cinders to a greater extent before they pass through the spark arrester. The smaller the cinder, the less the liability of setting fires, and it is the width of opening that guards against the dangerous cinder.

The Game, Fish and Forest Fire Department of the Public Domain Commission of Michigan, in their 1915 report on page 16, informally recommend the use of the oblong opening on account of the greater safety. They further state on the same page:

> "A dangerous cinder is the one of bulk, not area. The further removed the heart of the cinder is from the cooling air, the longer will it retain its high temperature."

It has been found, due to the greater effective opening and to the reduced friction due to less dead surface in the netting that the size of the nozzle tip can be increased after DRAFTAC has been applied. In other cases where the tip was not increased in size, better burning fires wre obtained which caused the engine to steam more freely.

This fact of incrased opening in the spark arrester is of great importance, as when the tip is opened up, the locomotive will work more freely and actually use less steam to do the same amount of work. Recent

tests showed a decrease of 6 per cent. in steam used to do the same amount of work after the nozzle tip had been opened up five-eighths of an inch. This was due, without doubt, to the reduction in back pressure.

As nearly 50 per cent. of the draft is lost by the time it gets to the front flue sheet, it is important that no more obstruction be placed in the draft than absolutely necessary. This being the case, there is a great field to work upon in working out the proper spark arrester to use.

We have used on a number of locomotives No. 393 DRAFTAC and on some engines we have found after DRAFTAC was applied, the nozzle tip could be opened up and we would still have the same amount of draft that we did with 3 mesh No. 12 wire. On other engines we did not open the tip, but had better steaming engines. This was all obtained with a much smaller spark, which was what we were working for.

This is a very important subject with us now and I trust that others will have some light to offer on it.

MR. PYLE: This is a reproduction of the stenographer's transcript of the discussion at the Fuel Convention. I think you are all interested in the requirements that are forced upon us. I don't have anything to do with boiler work other than I started in as a railroad man in the boiler shops. I was a boiler maker's helper and then I went into the engine service. The requirements of the State of Michigan are working a hardship, due to the requirements for spark arresters and if this state succeeds in having this passed, other states will do the same and you know what that will mean. It seems to me that the time is coming when you gentlemen are going to be called upon to operate your locomotive with a small mesh netting, and if Mr. Lucas is in the room he can tell you just what we are up against in Michigan. I would suggest that this Association go into this matter of a spark arrester, that you give us some information on it so that when we go before the commissioner, we will have something to tell him. We can tell him the things we can do and the things we cannot do; we can give him some accurate statistics, and if you gentlemen will take some action on the spark arrester question, we can tell the commissioner we can do so and so. We can make a recommendation on your suggestion and he will know that some serious thought has been given to this question. I thank you all for your attention.

On motion of Mr. Madden the suggestion was referred to the Committee on Topics for the next convention.

THE PRESIDENT: We will not go on to our regular order of business. First on the program is, "What are the Advantages and the Disadvantages of Fusible Plugs in Crown Sheets of Locomotive Boilers?" A. R. Hodges, Chairman.

REPORT OF COMMITTEE ON

"Advantages and Disadvantages of the Fusible Plug."

Your committee submit the following report on "What Are the Advantages and Disadvantages of the Fusible Plug in Crown Sheets of Locomotive Boilers?"

The design of the fusible plug is similar to the wash out plug in its general construction, except it is not so large, and on its inner face is made conical or concave, penetrating in its depth to about ⅜ inch or ½ inch of its entire thickness; then a ¼ inch drill is used to pass through it entirely.

This brass plug, measuring about 1¼ inches to 1½ inches in diameter, composes the plug which contains the fuse. Into this concave inner face is poured a soft metal which should fuse or melt at not less than 650° F. H.

This plug is applied between the first and second rows of crown bolts or radial stays at the front end of fire box near back flue sheet, at which locality low water would first be in evidence, due to the fact that the crown sheet at this point is something like 3 inches on an average higher than any other part of the fire-box.

The function of this fusible plug is to fuse when low water exists.

The moment water in the boiler becomes sufficiently low to expose this part of crown sheet to the direct attack of fire being unprotected by water, the temperature at this point would increase rapidly to such a degree as to cause the fusible metal in plug to melt and flow out through the ¼ inch opening in bottom of plug, followed simultaneously with a profusion of steam, which would extinguish the fire, and kill the engine, or render the locomotive useless without any further damage than has been mentioned; thus also avoiding the rupture of crown sheet and possibly averting boiler explosion, which carries with it the destruction of property and the snuffing out of human lives.

This, then, is the function of the fusible plug. It is to reveal to the engineer, not only when his water has become dangerously low, but when metal in crown sheet has been increased in temperature to such a degree as to render it unsafe to continue another moment. It is an ultimatum to the engineer concerning his water, and the high temperature in the fire box. It is a miniature explosion, the nature of which is to avoid any further damage, and to avert a more appalling catastrophe.

The function of the fusible plug also embodies the advantages of the fusible plug. They are inseparable, but if it is to retain its efficiency, perform its function, and prove an advantage, it must be given the proper attention. To do this, it should be removed and cleaned at least once every 30 days; preferably at the time of each stay bolt inspection. If permitted to remain in crown sheet more than 30 days, or for an indefinite period of time without proper attention, a thin scale will form over the fusible metal and an accumulation of mud will gather around the plug, thus forcing water away from the plug, permitting it to reach a higher temperature than it should, and causing the soft metal to fuse or melt, producing the same effect as though there had been low water, when such was not the case.

When the fusible plug is permitted to be in this condition it is quite evident that it ceases to be an advantage, but altogether a disadvantage, and should be removed entirely.

Again, it is affirmed that low water has really existed in boilers which contained fusible plugs which were in good condition and performed their proper function at the time; but, the engineer, in order to cover up the fact, and protect himself from exposure, entered the fire box when possible to do so, and with a rat-tail file which he used as a plug, drove into the small ¼ inch opening in the lower side of the plug, and attributed the cause of failure to something else. If the engineer is detected in this, the fusible plug is an advantage in more than one way; if not, then it proves a disadvantage.

Then again it is held by some that the grade of the road bed and the short stops of the locomotive, produce unleveled water in the boiler, which makes it difficult to keep the fusible plug covered with water at all times, causing the metal to fuse when low water did not actually exist, thus rendering the fusible plug a criminal disadvantage. Be this as it may, we are somewhat dubious as to the correctness of this contention, while not wholly disagreeing with the above opinion, yet we doubt very seriously that water should be carried so low as to leave the fusible plug unprotected, regardless of grade conditions.

In the foregoing we have dealt with the design of the fusible plug, its function, advantages and abuses, but in the following we wish to point out its positive disadvantages.

First: The location of these plugs is such as to render them a disadvantage. In placing them between the first and second rows of crown bars or radial stays in forward end of fire-box near back flue sheet subjects them to a fierce attack of fire which burns the plug out very often, necessitating its removal.

Second: On account of the thickness of the plug, including the fusible metal, places fire-box side of the plug an excessive distance from the water. This permits the brass part to reach a high temperature which may be sufficient at times to cause fusible metal to melt without low water.

Third: Variation in the temperature of this plug and the crown sheet surrounding it, renders it difficult to be maintained tight in the sheet, the square having become defective, and the threads burned and corroded. It is almost impossible to tighten with wrench effectively. Therefore, it is necessary to resort to the hammer and caulking tool to stop the leakage, or else remove the plug, clean out the threads and apply a new one. This we deem necessary once a week, or at the end of each round trip, (water conditions governing.) This procedure will rapidly enlarge the hole in the crown sheet, as well as increase the diameter of the plug, making it necessary in a short while to apply a patch, or bush the hole in order to reduce it, which in time would prove more troublesome than a leaky plug.

Fourth: The continuous and frequent removal of fusible plugs in order to maintain them tight and serviceable, would require the lowering of the water each time this operation was performed and when terminated the water would necessarily have to be raised. If there is a hot water washing plant in operation, well and good; but if not,

it follows that cold water must be forced into the boiler, which is very damaging to the flues and fire box sheets.

In concluding this report we wish to say that the fusible plug has doubtless been extensively used, more or less, on all of the railroads of this country, but seems to have met with disfavor, and is now being dispensed with. Whether this action is due to prejudice, or influence, or abuse of the plug, or whether the disadvantage outweighed the advantages, are questions worthy of debate and a thorough analysis, which we now submit to this convention for your consideration and discussion.

A. R. HODGES, Chairman
F. A. BATCHMAN
WM. M. KEATING

.. MR. HODGES: As all of the members have been furnished with a copy of the report, I don't think it is necessary to read it with the exception of the last paragraph.

THE PRESIDENT: If any of the members have anything to say on this subject, we would like to hear from them. Our railroad does not use the fusible plug, but there may be some who do.

On motion of Mr. Lewis the report was received and the committee discharged.

THE PRESIDENT: The next subject this afternoon is, "What are the Advantages or Disadvantages in the Use of Standard Thickness of Copper Ferrules for Both Good and Bad Water Districts or Territories? Is It Better to Use Light Copper in One District and Heavier Thickness in Another or Is Any Difference Experienced?" W. H. Laughridge, Chairman; D. A. Lucas and George B. Usherwood, committee.

MR. LAUGHRIDGE: Inasmuch as this subject has been heretofore threshed out on two occasions, the committee did not get enough valuable information to present an intelligent report; therefore, there is no report on that subject. This being the case, I would move that the subject be passed. Carried.

THE PRESIDENT: The next subject is, "Cleaning Boilers in Backshop or Round House When All Flues Have Been Removed and the Most Economical Way of Doing It." George Austin, Chairman; G. C. Dean and T J. Reddy, committee.

THE SECRETARY: There is only a written report, which was left by Mr. Austin, who has been called home. He asked that some member of the committee present the report.

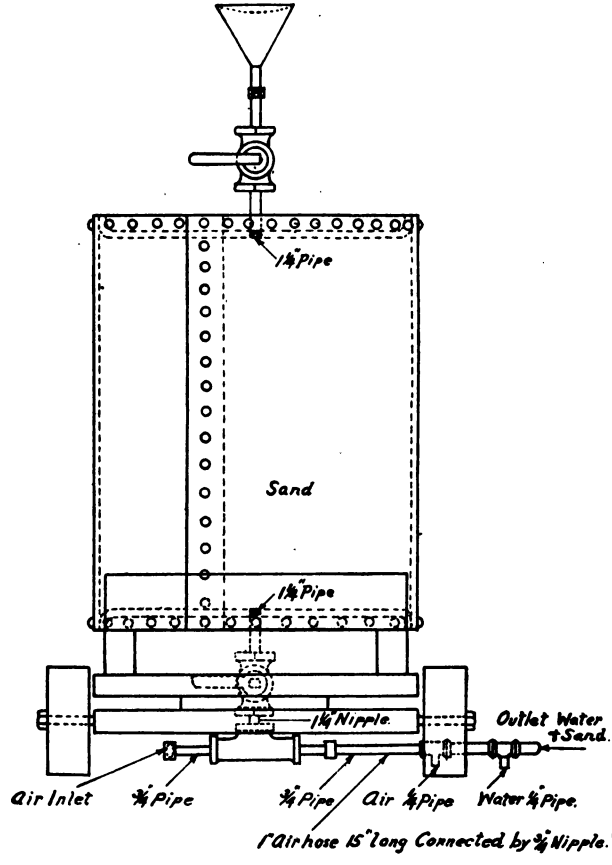
THE PRESIDENT: I believe it would be in order for the Secretary to present the report.

REPORT OF COMMITTEE ON

"Best Method of Cleaning Boilers in Back Shop or Round House When all Flues Have Been Removed and the Most Economical Way of Doing It."

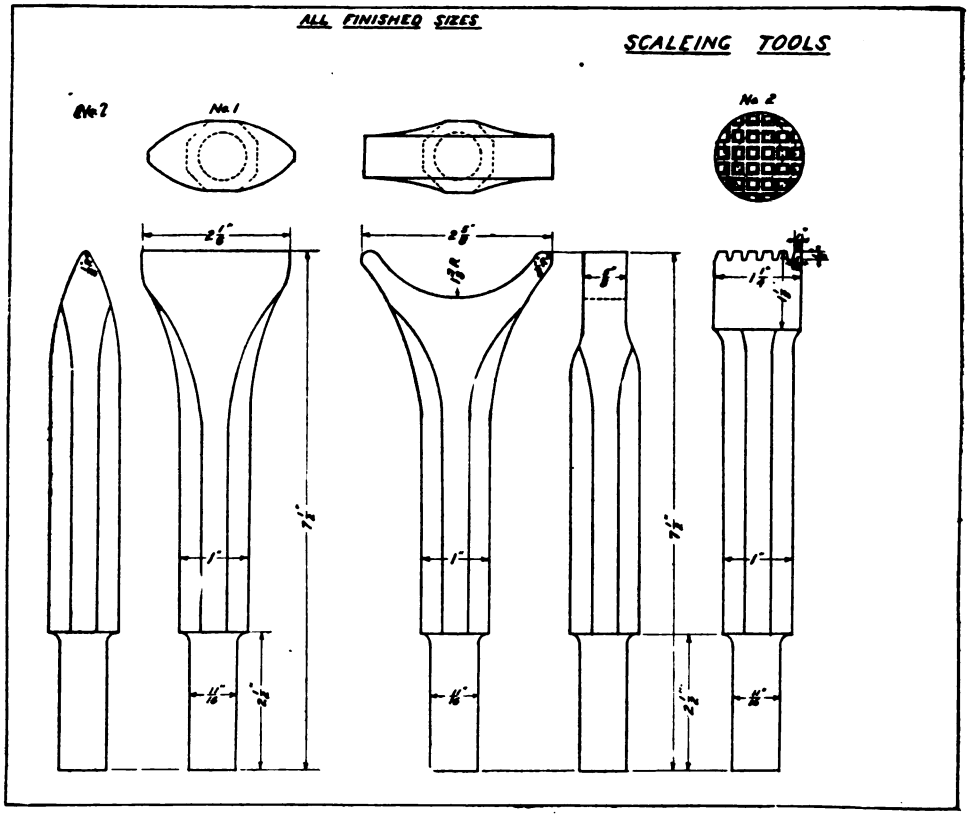
Your committee would respectfully report that we find the general method of cleaning scale out of boilers is by using a pneumatic hammer and scaling tools of the general design shown in the sketch.

Among the answers received we have had several suggestions



Sand Blast Machine For Cleaning Boilers.

that light, rapid hitting pneumatic hammers be used for this work; some have suggested that practically worn out hammers are used; one member suggested the use of a marble cutter's pneumatic hammer and claimed a saving of 50 per cent in time. Your committee believes that a very light, rapid hitting hammer would be more profitable than an ordinary sized pneumatic hammer, such as is generally used around the boiler shop or round house, both in doing quicker work and less liable to scar the plates.



Your committee also have some knowledge of the use of the wet sand blast for cleaning the scale from the inside of a boiler. The objection seems to be that it is a little hard on the operator and makes quite a muss about the shop where the work is being done. The cost per engine is not much less than the hammer and scaling tool method, but does a better job.

As to the cost of cleaning a boiler, that is largely a local proposition. It depends on the character of the scale to be removed, the size of the boiler and how complete a job of cleaning is desired.

It is possible that we may do more cleaning than is actually

necessary, even for the purpose of thorough inspection. Some of our replies indicated that a slight scale was beneficial rather than detrimental; that cleaning seams, laps and flanges and lower parts of shell for inspection purposes was all that was really necessary; and that this could be done somewhat cheaper than going over all parts of the boiler and cleaning it thoroughly. It was also mentioned that the use of scaling picks and air operated cleaning tools scarred the metal and probably rendered it more susceptible to pitting. This was not confirmed by any testimony given. It was also stated that a thin layer of scale was a protection to the metal against pitting and was also beneficial to some slight extent as a non-conductor.

The largest percentage of our replies, however, indicated that our members are in favor of cleaning off all scale, as well stated by one member, if for no other reason the slight extra cost of thoroughly cleaning is more than paid for by the satisfaction of having the work well done. Your committee therefore conclude:

First—That when the flues have been removed the boiler can ordinarily be cleaned by the use of air hammer scaling tools in from eight to fifteen hours. Where the firebox has also been removed it would take about five hours longer.

Second—That the picks and air hammer tools should not be sharp enough or hit hard enough to scar the metal; not because it is liable to increase pitting but on account of roughing the surface it is liable to make the next job of cleaning more difficult.

Third—That the sand blast method of cleaning boilers, taking into consideration the cost of sand and apparatus and maintenance, is no cheaper than the first method, but it does do a better job, leaving a much more uniformly clean, smooth boiler. The system might be profitably adopted where facilities could be provided, such as a cleaning pit for that special service and crane service to bring the boiler to it.

Sketches showing general design of cleaning tools used in connection with pneumatic hammers, and also with wet sand blast are attached. It is recommended by one of the committee that painting the interior of the boiler protects the metal from corrosion and on account of paint, a better and quicker job of cleaning can be done.

GEO. AUSTIN, Chairman,
T. J. REDDY,
C. C. DEAN.

THE CHAIRMAN: Gentlemen, you have heard the reading of this report, what is your pleasure?

MR. LAUGHRIDGE: I move the report be received and opened for discussion. Carried.

THE CHAIRMAN: Is Mr. Dean in the hall?

MR. C. C. DEAN: After this committee was appointed to investigate the best manner to scale a boiler after the flues were removed, each one of the committeemen took this question up with his boiler foreman friends throughout the country and asked for advice as to the manner in which they scaled a boiler. After these answers were received the report sub-

mitted was made up from the information obtained in this way. At the Wabash shops in Decatur, Illinois, we use an old air hammer and tools for scaling as shown by the sketch attached to the report.

THE PRESIDENT: Is there any member who would like to tell us something in regard to this? I think Mr. Hodges ought to tell us something about what they are doing. He is in a bad water district.

MR. POWERS: Will some member of the committee tell us whether they received any information about a sand blast with water to keep the dust out?

MR. DEAN: As none of those with whom we took up this question used the sand blast, I cannot give any information as to its use.

MR. CONRATH: They are using this sand cleaning device on the Southern Pacific, and if any of their representatives are here they could tell us about it. They have been using it for some time with very good results. They use water with it to keep down the dust and do a very neat and clean job.

THE PRESIDENT: Is anybody from the Southern Pacific here who could tell us about that?

MR. H. WEST: We have been able to clean the boiler of scale in about six hours with the sand. It is not exactly sand, but a small gravel. We use it with the water and it is giving satisfaction. We use a drum about 48 by 60 and we begin at the top and run the gravel down to the bottom. It is in cone shape, the bottom head pipe being about an inch and a half. The gravel and the water go in together. We clean the superheater tubes the same way. This is not an invention of our own. We got it from the Southern Pacific. We have cleaned a boiler in five hours. You have to get a fine gravel and you also must provide your operator with a pair of goggles to keep the dust away from his eyes, and an apparatus to keep the dust and water away from him.

MR. BAIRD: We all know that three methods are used in cleaning the interior of a boiler, while undergoing repairs—dry sand blast, wet sand blast, and pneumatic hammer. As to the sand blast, wet or dry, no one can work on the boiler while it is being cleaned in this manner, as it makes considerable muss. We use a small light hammer, and get good results, and have our men avoid cutting as much as possible into the skin of the metal of the shell, or plate. The sand blast method, I have to admit, makes a more perfect job, but rather than give the boiler over to the men doing the latter work, we have gone back to the use of the light pneumatic hammer. This takes about 15 hours to go over the entire boiler.

MR. STEWART: We use a stone cutter, pneumatic hammer, and an inch and a quarter chisel. We have very cheap labor and we can put them on the boiler and this does not interfere with any work that is going on. We find the use of the chisel a very cheap method of scaling the boiler.

THE PRESIDENT: What is your time? How many hours does it take?

MR. STEWART: It depends upon where the engine is from. If from Florida, where they have a sandy loam, it only takes four or five hours, but if from Alabama, where they have a red clay, it takes longer.

MR. HODGES: What is the average time?

MR. STEWART: About eight hours, including two men for scaling the boilers. It depends on the fellow behind the hammer, you know.

THE PRESIDENT: Has anybody else anything to offer about the scaling of a boiler?

MR. HODGES: My experience has been largely the same as that of Mr. Baird. I am located in the south at the present time, and we employ colored help. Our boiler makers and apprentices are too valuable to place on this class of work, so we use this cheap labor to perform this task. We have not a great magnitude of boiler work and can take care of this item in the manner stated. We use the colored help one and sometimes two hours after the mechanics have gone home in doing this and other similar kind of work.

MR. WANDBERG: Another disadvantage about using the sand blast besides making a nasty mess around the shop is the possibility of cutting the metal by using too much of it. This operation might be done when there was nothing else to work on. If that is the only point about it, I think it ought to be considered.

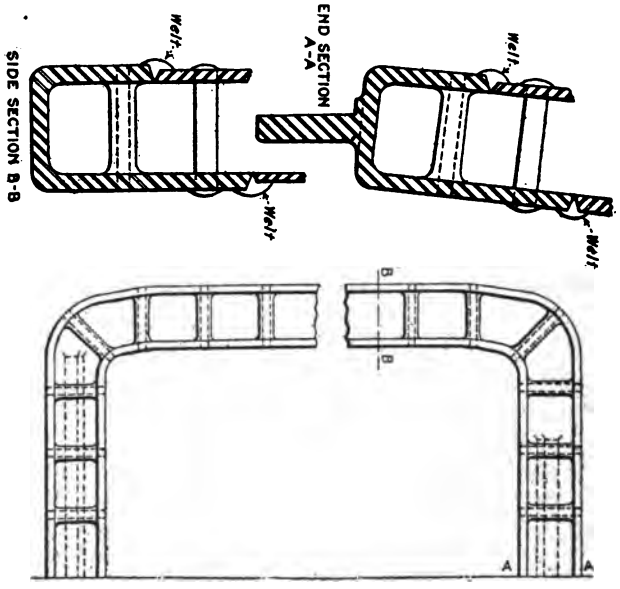
MR. LAUGHRIDGE: It seems to me that the question of cleaning the boiler is one for the individual to solve. Each man cleans to suit himself, and I move the subject be closed. Carried.

THE PRESIDENT: The next subject is, "What is the Proper Thickness and Best Mudring to Use in a Locomotive Boiler to Keep Sidesheets from Cracking?" T. P. Madden, Chairman; M. O'Connor, T. P. Green and D. G. Foley, committee.

REPORT OF COMMITTEE ON

"Proper Thickness and Best Mud-Ring to Use in Locomotive Boiler to Keep Side Sheets from Cracking."

The accompanying illustration shows a cast steel mud-ring invented by Messrs. Smith and Harter of the Missouri Pacific Rail-



way, Assistant Mechanical Superintendent and Mechanical Engineer respectively.

This ring is channel shaped with flanges on each side to take the fire-box sheet, the inner flange being half a stay-bolt pitch shorter than the outer flange in order to facilitate the welding of firebox sheets to same and keep the seam below the fire-line; also to secure a row of stay-bolts in casting and sheet in order to take care of the stresses in welds.

To secure the two walls from spreading and give required stiffness at the bottom of the ring, braces are cast between the walls. In these braces a ¾" hole is cored to lighten the casting.

A mud-ring of this description will have many advantages over the present ring in use. Being very much lighter in construction naturally makes it more flexible and eliminates stresses in firebox sheets caused by the rigidity of the present design. It will be a smooth surface on side sheets, permitting cinders and ashes to pass into ash-pan and prevent side sheets from rusting away, owing to the rivet heads of mud ring obstructing ashes that pass between the grates and side sheets. With the mud-ring welded it should also eliminate all mud-ring corner trouble, which is very annoying as well as costly to railroads in bad water districts.

There are many other good features in connection with this style of mudring which can be discussed at the next convention.

Yours truly,

T. P. MADDEN, Chairman.

Mr. T. P. Madden, Chairman, St. Louis, Mo.

DEAR SIR: Referring to your letter of Feb. 6th and recent correspondence, the following is a synopsis of my experience:

In good water districts the side sheets do not begin to crack until the locomotive boiler has had from 10 to 12 years' service. With this same boiler in a bad water district the side sheets would begin to crack from three, four or five months, and probably a little earlier. Have found this to be the case where the mudring was two inches thick, three inches wide on the side and three and one-half inches wide on the front and rear end. Find it also the case where the mudrings are three and one-half inches to four inches thick and from three and one-half inches wide on the side to four and four and one-half inches on front and rear end, and it is my opinion no mudring, no matter what design, thickness or width, will prevent side sheets from cracking. It might be possible to design a mudring of increased width which would prolong the cracking of side sheets in either a good or bad water district.

It has long been considered by boiler makers of experience that where mud pockets are allowed to form in the leg, also a heavy scale allowed to form around the staybolts, it will shorten the life of side sheets because of being overheated, creating a tremendous amount of expansion and contraction. Careful inspection and cleaning of boiler will prolong the time of cracking of side sheets. Of course, it is understood that the best of firebox material is to be used.

In good water districts where there would be scarcely any accumulation of scale on the staybolts or in the leg of boiler, after a certain number of years the side sheets would crack. These cracks take place at either above or below the staybolt holes, and it has been my experience they develop because of the side sheets becoming crystalized. Have also found, and no doubt all have, that the cracks usually develop at the fire line or below it, it being a very rare case where we find cracked side sheets above the fire line.

It has been my experience in more than 30 years, that it is impossible to prevent side sheets finally cracking, but the time of cracking can be prolonged by having good material used in the side sheets, flexible staybolts applied, and keeping the legs of boiler and plates clean and free from scale and mud pockets. While this is an easy matter in good water districts, believe it could be also done in bad water districts by having the water treated before going into the tanks of tenders, and if necessary chemically treated, before entering the boiler, by frequent blowing with the use of surface cocks, also blow cocks around mudring and frequent and thorough washing of the boilers.

The width of the mudring in my opinion should be left to the mechanical engineer to submit to the Superintendent of Motive Power, as experience they have in matters of this kind guides them as to what width and thickness is necessary for the efficiency of the boiler.

D. G. FOLEY, Member of Committee.

Mr. T. P. Madden, Vice-President Master Boiler Makers' Association, St. Louis, Mo.

MY DEAR SIR: I am somewhat familiar with the subject matter owing to the difficulty we have in broken mudring corners on our large

power. To overcome this trouble, we are now reinforcing the mudring when engines are in shops for new or heavy firebox work. This reinforcing consists of adding seven-eighths thickness on top of ring for a distance of 12 inches to 14 inches around corner, also on bottom of ring. Some of our power has heavy re-inforcing in the shape of a rib, which is welded to the original ring on the bottom. It drops down about four inches below the rib proper, for a distance of 12 inches to 15 inches both ways of the center of corner.

These rings we find to be O. K. and give no trouble at all. I recommend the double rivet mudring. We have no trouble from cracked side sheets caused by either single riveted or double riveted mudring; neither are we bothered from leaking staybolts caused by any unnatural action of mudrings.

Yours very truly,
M. O'CONNOR,
G. F. B. M. Lines West C. & W. Ry.

MR. MADDEN: Being on the road a good deal the reports of two members of the committee were not forwarded to me, but I have them here and will have them inserted in the minutes, if necessary. They do not dwell on the special design mudring, but this is something new in the construction of locomotive boilers; in fact, I have never seen one put in use. We have now a detailed blueprint with a description and we are getting the price on the pattern. It is our intention to apply one of these mudrings and I hope to be in a position to make a more complete report at our next meeting. By glancing over the sketch, you will notice that the mudring is made of very thin cast steel. The later blueprints show the thickness of the wall. It will be much lighter than the mudring now in use, and, therefore, more flexible. In my opinion it should respond more readily to the different temperatures of the firebox. This being the case it should eliminate some of the stresses on the firebox plate. Another advantage of this mudring is, it will eliminate all rivets. Owing to different devices of welding it has enabled the designer to get out this ring and be welded, as we think, successfully. It will also eliminate all mudring corner trouble. It will also eliminate the corrosion that takes place above the mudring rivets. This is something new to me, as well as anyone else, but I hope to be in a better position to give you a more detailed report later. I have several blueprints showing the dimensions, thickness of the wall, etc., and I will be glad to answer any question as far as I am able. Anyone who would like to have a blueprint may have one, as far as those I have here will go, or members can write to me and I will be glad to send them one.

MR. LAUGHRIDGE: Inasmuch as none of the members have had any experience as to this, and Mr. Madden having evidently given us as much as he knows about it, I move the subject be closed.

MR. FOWLER: Before that motion is carried, may I have your permission, Mr. Chairman, to speak on the subject?

THE PRESIDENT: Yes, Mr. Fowler.

MR. FOWLER: I was very much interested in this paper, more so than any other presented before this Association this year, because it was right along the lines on which I am working in my own research work. We all know that considerable stress must be put upon the mudring. A number of years ago we were in the habit of riveting the mudring with a single row of rivets, but it did not hold; we were obliged to use a double row of rivets in order to keep the ring tight, and naturally there must be a pulling, a twisting, something there to make a leak, which occurs if you have a single row. You remember last year when we were discussing the subject of firebox expansion, I called attention to some investigations that I had been making at the Collinwood shops, in which the indications were that there was a decided buckling of the inside sheet down toward the bottom near the mudring. I say "indications" because I could only account for what happened to the apparatus by the fact that there was a buckling, which explained it and nothing else. Now if you take a mudring shaped like this one, and suppose the inside sheet to be welded along the short length, the inside sheet will expand and push down on the ring, which will have to yield at a lower point, and the stress and strain will be taken off the inside sheet, so that it can hold its position, keep straight and throw the whole stress on the mudring; but when that is done—now I am going to criticize the drawing in the report—you have jumped into another difficulty. We all know that a number of years ago, we started in to make a firebox flexible by putting corrugations all along on the inside sheet. It was a beautiful theory, but, unfortunately, it did not work; the movement backward and forward of the inside sheet expanding and contracting, and the rigid staybolts that were in there simply cracked the sheet and the whole scheme had to be abandoned. At other times attempts have been made, within the experience of everyone here, of putting corrugations in the tube sheet, but they have not worked well. They have cracked on the inside of the curve. What I should be afraid of with that form of mudring unless it is exceedingly carefully designed, is that it will crack on the inside. I have a drawing which shows how that could be made, a half circle—

MR. MADDEN: Just a minute, I told the convention I had a detailed report and it shows just exactly what Mr. Fowler speaks of; the drawing has been changed since the original report was issued.

MR. FOWLER: I want to congratulate myself because the gentleman has done exactly what I was going to suggest, he has provided for the trouble I had anticipated. He has made it a half circle with staybolts on the diameter, and with pressure on the inside, it is thrown down at the sides, making the maximum stress at the bottom, while if the load at the bottom tends to push it up, both stresses have a tendency

to cause a crack at the bottom. Now the point is to so design the curve in there that the bending stress would be evenly distributed, so that no matter what the bending stress was there it would be the same over the entire length. Glancing at the blueprint, it is practically what the gentleman has done. I have one recommendation to make and that is that when you make this up, you put in the very best material. I would suggest a high vanadium steel with an elastic limit of 45,000 pounds, which may eliminate cracking. I am sure that the inside sheet buckles and it stays buckled all the time it is in service, it buckles at the time the engine starts to get up steam and stays buckled until it is back in the roundhouse. (Applause.)

MR. GOODWIN: I rise to call your attention to something that possibly has slipped the memory of some of us, and in reference to a man who attended our conventions for a number of years and who was thus long identified with it. I refer to Mr. J. D. Farasey, Secretary of the Boiler Manufacturers' Association, who died a few months ago. Men who knew Jim Farasey loved him, and I think it would be perfectly proper for our Memorial Committee to propose resolutions recording the passing of our friend and associate and have it inserted in the proceedings, a copy to be sent to Mrs. Farasey, who is living in Cleveland. I offer a motion to that effect. The motion was carried.

MR. GOODWIN: I understood that we had had no deaths in this Association during the past year; that was my impression, but I understand that Mr. P. J. Flavin was a member, and he died during the past year.

THE SECRETARY: I had not heard of it.

MR. A. N. LUCAS: If I am in order I would like some information in regard to arch tubes. How many members here are using No. 7 gauge or heavier; how many are rolling and beading the same? This question has come up recently. We have been using a lighter gauge for many years and we are now going to use No. 7 gauge. The question was brought up as to whether it would be best to bell them out with a special roller or bead them. I would like to know what the practice of the majority is in this respect. (About one-third of the members rose.) How many are beading them? (A majority of the members standing held up their hands.)

THE SECRETARY: The secretary told you that the prospect was for 60 new members at this convention. We have 58. (Applause.)

MR. A. G. MCDOUGAL: Is this not a good time for asking questions?

I believe someone asked that we devote an hour to it and I think this would be a good time to do so. We have plenty of time this afternoon.

MR. GOODWIN: This is about the ninth or tenth annual meeting and the past presidents have organized what is to be known as the Past Presidents' Association, which will work and act in conjunction, of course, with the Master Boiler Makers' Association. The men who have been honored by this Association with the presidency are proud to-day of this organization. While we will meet together and talk over matters that are of interest to ourselves, we do not want to estrange ourselves from this organization. Our object is close unity with one another and to stimulate a brotherly feeling for one another, keeping in close touch with one another's interests, their sorrows and their joys. Therefore, all members of the Past Presidents' Association present are asked to meet just after the adjournment of this meeting for the purpose of permanent organization. We hope we will have your good will in this matter and we want you to understand that this organization is being formed in the interests of the boiler makers' profession. We want you all to be with us in this work and we hope to be able to be of some benefit to you. (Applause.)

THE PRESIDENT: If anybody else would like to ask any questions we have a little time this afternoon. If you have any information about new improvements in your shop or anything of that kind that would be of benefit to us when we go home, I think you should give it. We want to be educated and become more proficient. When we return home we want to be able to show our superiors that we derive something beneficial from these meetings. I know that nearly every gentleman here has some little device in the shop which it would do some of us good to know about. No matter how small your shop, you may be able to help a man who runs a big shop. I want the members to tell us something so we can improve our method.

MR. YOUNG: Just a minute ago all members that were using seven gauge or heavier arch flues were called upon to stand and then all those that were beading them were asked to stand. What I would like to know is do you bead them down to the sheet or just bell them out. I don't think they all understand what was wanted; therefore, I would like to have all those that bead them down to the sheet to hold up their hands; now, those that just bell them out. They seem to be equally divided.

THE PRESIDENT: Just about half and half.

MR. D. A. LUCAS: I do neither. We bead within a sixteenth.

MR. CRITES: I know of a little invention perfected for the sake of

humanity and to benefit the men working on the front end. When the engine comes in the house it is warm. A patch may have to be put on the netting, or the blow pipe repaired, or the front end examined for a leak. A man from New Jersey told the foreman at Sodus Point, N. Y., to use a half-inch pipe that will extend from the firebox flue sheet, and carry it out through the fire door, so as to be able to stand alongside and connect the air hose; then make a bend of half of a three inch circle and extend the end out straight toward the fire door eight inches, put on the air and all the hot air in the front end will be drawn into the firebox and carried out of the fire door. Then it is possible for a man to work in the front end without any discomfort.

MR. HODGES: We will make one when we go back.

MR. CRITES: I would like you all to try that when you go home. I just want to tell you that it is not my own invention. I have heard that everybody has an invention, but I have never found out what mine is yet. (Applause.)

THE SECRETARY: If someone will get busy we can have 60 new members. We have 59 now. A motion is needed to confirm the recommendation of the Executive Board that the applicants be admitted to the Association.

MR. D. A. LUCAS: I make a motion to that effect. Carried.

THE PRESIDENT: Now I hope some of the other members will have something interesting to tell us.

MR. A. N. LUCAS: In regard to the front end and the blower pipe. The old method for the last 50 years or more was to drill a hole in the smoke arch, put the blowpipe below the netting, and then bend the pipe and come up in front of the exhaust pipe. This blower pipe is full of water all the time. Every time we wash out the boiler, we wash the front end. The boiler washers disconnect this and kick it out of the way. Then it would be put back, it was never tightened up and the steam always leaked. I think the proper place, especially where we are adopting the front end self-cleaner and lowering the exhaust pipe, for the blower pipe would be above the netting. It should be put in and anchored so that it won't move. This will do away with the wearing of the hole in the plate and around the exhaust pipe and allow the sparks to come out. I think if you will take that home and try it you will like it.

MR. GRAY: I think Mr. Lucas made a very good suggestion. For the last 15 months we have stopped up the old blower hole and drilled a new one just at right angles with the nozzle tip, running the pipe right

WASTE of TIME in CONVENTIONS

A great deal of time is wasted at conventions by the chairmen of committees or the authors of papers reading the reports in their entirety. These reports are almost invariably printed and distributed to the members in advance so that they may familiarize themselves with their contents and come to the convention prepared to discuss whatever portion of them they may be interested in. When it is the intention that the members shall be familiar beforehand with the contents of papers, why take up the time that might be given to discussion or other work in the convention by reading reports that the members are perfectly capable of reading themselves? the railway mechanical associations could very well profit by the example of the American Society for Testing Materials. This Society has definite rules governing the presentation of papers and reports and these rules are printed in the program of the convention. The following is taken from the first page of the program for the nineteenth annual meeting held last week in Atlantic City:

Presentation of Papers.—Papers by members in attendance at the meeting shall take precedence over papers by absent members. The latter may, at the direction of the chair, be presented only by title. Authors will be expected to confine themselves to brief references to the principal features of their papers. In general, the time allotted to the presentation of a paper shall be limited to ten minutes. The time may be extended, however, for special reasons, at the discretion of the chair or by a vote of the meeting.

Presentation of Committee Reports.—Committee reports shall also be limited in their presentation to a brief summary of their principal features; but matters which are to be referred to letter ballot of the society shall either be read in extenso, or acted on as printed without reading, according to the expressed sense of the meeting.

As an example of the way this procedure works out in the conventions the report of the Committee on Steel, which constituted a book of 100 pages, was presented in about 15 minutes. This waste of time in conventions has been called to the attention of the officers before this and it is high time that something definite was done to make better use of the time spent at conventions, particularly as the number of subjcts which demand attention is constantly increasing.—Railway Age Gazette.

straight across and turned it up at the edge of the nozzle. We have done away entirely with the old style blower.

MR. POWERS: For my personal information, I would like to have some of the members of this Association tell how they have overcome the pitting of flues. We are spending thousands of dollars every year on our line because of pitted flues and boiler shells. I don't think we could listen to anything more profitable than a discussion of that.

MR. WANDBERG: I have been requested by my superior officer to ask this Association to come to some decision on the subject of pitting. It is one of the worst troubles we have and I notice not a word has been said about the pitting of flues in particular. A year is about all we can get and we have reached the stage where it is very expensive and I think the attention of members should be called to it to see if some means of eliminating it cannot be had.

THE PRESIDENT: Do you weld the pittings?

MR. WANDBERG: It is beyond that, they extend from one end to the other and all around.

MR. FOWLER: May I make an attempt to answer that question in part? The last six months I have been engaged in examining water. I made some investigations in the usual way, had the water analyzed from a tank and it appeared to be the most innocent water in the world; nothing the matter with it, no reason why it should do any injury to the boiler. Then I looked at the boiler and the tubes were pitting out in about nine months. Evidently there was something the matter with the water or my chemist, and I was sure there was nothing the matter with the chemist.

Then I took another course, I quit analyzing the water in the tank and began analyzing the water in the boiler, and then I found an entirely different story. I found that in high pressure boilers working under 200 pounds of steam, the quality of the boiler water is just about as much like the original as a broiled steak is like raw steak; it is not the same at all. I was a little uncertain about it because, though we were taking water out of a locomotive that had been filled with water from the very same tank, I was afraid that the water might undergo a change during the day, or that the locomotive might have taken on water at another tank. So we made a boiler where we could analyze the water and evaporate it and the same thing happened; the water was worse than the water taken from the regular boiler.

MR. HEMPEL: Some years ago—I think it was at the Columbus meeting—the question of testing the water was brought up, and I think the

proceedings of that meeting will show that there was considerable discussion upon the subject of water. I remember the statement I made at that time that in my opinion, after the treatment of water, a reaction took place, due to pressure and temperature and the influence of the boiler. Mr. Fowler's talk just put me in mind of that, so I want to tell you of something we tried to overcome that. You will all possibly be surprised by what I am going to say. We took a boiler in at North Platte—engine 112—and it was very badly pitted. We called upon our chief chemist, Mr. Harriman, and he thought he would get somebody who was pretty well posted. He called upon Mr. Kenny, of Chicago, who was looking after the treating of water upon our system at that time. After going down into the boiler (the three of us), he thought he had discovered that there was some chemical action of some kind. I can't describe it, but he said it ought to be neutralized, and he said he would put some zinc in the boiler. We put in 1,500 pounds of zinc, suspended it crosswise to the boiler head of the firebox, over the flue connected with the shell of the boiler. The engine went 122 miles and back and how much of that zinc do you think was left when the engine returned? Nothing was left of the 1,500 pounds. So you see it did not neutralize that action. There is something else that takes place. The boiler is not made to chemically treat water. It should be treated, if possible, outside, but when we do something else, it sets up reaction. I think that Mr. Fowler is on the right trail, getting after the boiler to see what is in it, and that is just what we must do if we are ever to overcome this pitting. If any man ever does discover that, I believe it would be his fortune. I think he could make a million dollars. The railroads would give him that if they knew how to prevent pitting, thereby keeping their flues from failing. I think such a sum of money would be given to the man who could find something that would prevent pitting, but in the meantime we must do what we can in order that the boilers may give us the best service. We took deep well water which pitted and I advocated surface water, knowing of the alkali, another of its ingredients. I think it is more beneficial than deep well water. I wanted the river water—the Platte River runs through there. They dug a well, but only went about to the river level and the water was much better. It did not stop the pitting altogether, but it was much better and I noticed the conditions improved. I watched it for a few years, then we began using the brickettes, and I think there is something in these chemicals that you put in. I believe the brickette is beneficial in preventing pitting as well as scaling. Of course all these things are an expensive proposition and it is a question whether you are going to get a dollar back for the one you spend; and there we are. It seems to me that we are just as far away as we were years ago. However, it is interesting to hear just such talks as Mr. Fowler has given. I, for one, have been greatly interested. We never will get away from this until we can find somebody who is bright enough to determine the condition

of the water under pressure and the influence of the boiler while in operation.

MR. MCDOUGALL: On the Denver & Rio Grande we have one division where the flues pit. We have copper water and we found that we had to where the flues pit. We have copper water there and we found that a saving could be had by taking out our steel tubes and putting in iron, as we could only get from 9,000 to 15,000 miles out of the steel. In order to get around that proposition we experimented with iron by putting in six or seven sets of iron flues and have gotten anywhere from 23,000 to 34,000 miles out of them without any sign or evidence of pitting whatever, but the steel will wear out in anywhere from 9,000 to 15,000 miles.

THE PRESIDENT: Is there anyone else who can tell us anything that will be beneficial in this line?

MR. POWERS: In reply to Mr. Fowler as to water, I wish to say that we have a good water district and we have absolutely no pitting there. We installed some heaters for washing out purposes and filling up, and I know of one particular time when flues in a brand new heater pitted out in less than 60 days. We have tried both the iron and steel, but they are just about the same. The same water going into the locomotive does not pit at all. In another district it is just the extreme opposite; both the iron and the steel being pitted—one just as badly as the other. It certainly is odd. The Southern Pacific, I understand, made tests on some stationary boilers and I would like to know how they overcome pitting. I think if there is anybody here from that road it might be interesting to know what they are doing.

MR. D. A. LUCAS: I have experienced the same trouble as Mr. Powers. We tried both steel and iron, with practically the same results. There is a condition on which I would like the opinion of Mr. Fowler. I find in watching the flues that a set will be pitted at the front end and others at the back end. In my opinion some waters deposit the pitting product at a lower temperature and others at a higher temperature.

MR. FOWLER: Well, I can make a guess and that is all. If you take the water that I spoke of a few moments ago, where the magnesium chloride in it has broken down the salt, that water has got to be very hot before the salt will break down and apparently under the high pressure the same combination is necessary. I don't know but that magnesium chloride would only be formed under the condition at a high temperature and therefore the pitting would occur at the back end of the boiler; on the other hand magnesium chloride would break down under a boiler temperature corresponding to 60 degrees pressure; so if the magnesium chloride breaks down at that temperature it starts to form hydrochloric

acid right at the start. The gentleman asked a moment ago about the practice of the Southern Pacific. Now I am not connected with the Southern Pacific but I have been in correspondence with Mr. Babcock, who is in charge of the water purification there, for the past year, and I hear they are meeting with excellent results with the alkaline condition. Now you can take this alkaline water and another alkaline water and you will find that they are two different things. You take a water that is acid and we all know that the greater the acid in it, the more rapid the corrosion. Now as you approach the neutral point, the amount of corrosion that you get in the water will decrease until you get down to the natural, and then the water will be slightly corrosive, it may not show a trace of acid reaction, and it is very much like that with this alkaline water—it goes along until it gets to the point of no corrosion, until it is five-tenths of one per cent. alkaline, and along in that line there will be a very slight amount of corrosion, and then it may increase the corrosion at some time until it is one and a half per cent., and then it drops down just as suddenly as it increased. If you can get the alkaline beyond a certain point there is no corrosion, but you are apt to get a light water that will foam and the average engineer would rather have corroded tubes than to get a foam so that he cannot get his engine over a hill. Mr. Babcock is working along this line, and in my own work I have followed his lead in this matter and we have decided that if you get the alkalinity at about three-tenths of one per cent., that is inside of the point where the increased corrosion occurs and it is ordinarily a safe amount to use. That is what Mr. Babcock is doing on the Southern Pacific and he writes me he is meeting with marked success in stopping the pitting and corrosion in his boiler, both the locomotive and stationary. I am told that the United States Navy did the same thing. They carried their water to a high point of alkalinity, up to three per cent., which made a very light water, a water that would not do for a locomotive but apparently gave them enough steam so that it could get to the cylinder; and for a good many years they have been holding their water that way, but last February they issued an order that the water should be dropped down to three-tenths of one per cent. I have not been able to see any of the naval officers in charge of the work since that time, and I don't know the results, but the change was made after several years of successful fighting of corrosion, during which they had been carrying a high alkalinity. Now that is the condition that exists, as I know it, in the navy and also on the Southern Pacific. (Applause.)

On motion the convention adjourned for the day.

FINAL SESSION

THE PRESIDENT: The convention will please come to order. The first order of business this morning will be committee reports. I will first call on the law committee.

THE SECRETARY: No report has been filed.

MR. GOODWIN: We don't like the idea of the impression being given that the Constitution and By-Laws cost so much money.

MR. LAUGHRIDGE: I have an explanation of that. Any of the members who have made any such statement are entirely in error. The full cost was $25.

MR. GOODWIN: There seems to be an erroneous impression among members of our Association as to who are eligible for membership. If they will turn to the Constitution and By-Laws, they will see, if I am not mistaken, Article XI, Section 1, says: "Active members shall consist of Master Boilers Makers, Assistant Foremen and General Boiler Inspectors, who are practical boiler makers, filling such position at time of application." Now this does not include Round House Inspectors. but it does include inspectors who cover more than one point. You can readily see we could not afford to have a law whereby Round House Inspectors could come into this Association. Possibly a man might lay off for a while and another man be put in his place, and the man who was substituting would thereby become eligible to membership in this Association. Our Constitution mentions *General Boiler Inspectors.* My interpretation of that is, that it means the man who covers more than one point, and is regarded as a general boiler inspector and a practical boiler maker. This has come up in the minds of many members. I understand that since this convention began the Executive Board has been uncertain as to the proper interpretation of the clause mentioned. So our committee has seen fit to give its opinion.

MR. YOUNG: The trouble was the applications were not properly filled out. If the man is a Foreman or an Assistant Foreman, do not give his title as Boiler Inspector. Give it as Foreman or Assistant Foreman, as the case may be; then the Executive Board will know how to pass on the applications.

MR. HEMPEL: I think that we should all understand what the word "General Inspector" means; the man having this title has supervision over his system. For instance, take the case of Mr. Lewis; he was promoted to general boiler inspector and that carries with it supervision. That position is equal to any foreman's position, so I think it should be understood that the position carries with it supervision; if it does not, I don't think the applicant is eligible.

MR. G. W. BENNETT: The question has been asked as to whether a Master Mechanic can join this Association. Section 2, of Article XI, states that "Associate members shall consist of men who have served as Master Boiler Makers, or others whose experience shall be valuable to the Association. Such members shall not have the privilege of voting." Master Mechanics, Superintendents and Assistant Superintendents of Motive Power can join this association under that section as associate members, because their experience is valuable to the Association. When you elect any more honorary members you must suspend Article XI, Section 3, which says: "Honorary members shall consist of those who have served as active members and on account of old age or ill-health have been obliged to retire from active service; such members shall not be required to pay dues." We have made several gentlemen honorary members without suspending that section.

THE PRESIDENT: I hope all the members understand this. The Executive Board acts on all applications, and I believe they ought to see that all are properly filled out.

MR. GOODWIN: I understand that Mr. Pratt, who is a Superintendent of Motive Power, was elected an honorary member at our first session.

THE PRESIDENT: Mr. Pratt was elected an honorary member at Chicago. That is my understanding, but no record was made of it, so he was elected an honorary member this year. I believe that is the explanation.

MR. GOODWIN: Then we re-elected him. Now that is perfectly agreeable to me, provided we are within the law. I am glad to know that Mr. Pratt is an honorary member of this Association, but in the case of electing a gentleman who is not a practical man, Section 3, Article XI, is mandatory and makes suspension of that section imperative in order to elect him. I have been advised that this was not done, so Mr. Pratt's election was really unconstitutional. I do not know whether you want to take that up—whether you want to be governed by the By-Laws. It says that honorary members must have served as active members. Mr. Pratt has not been an active member of this Association, so I don't see how you could elect him an honorary member. You can elect him an associate member as you will learn by referring to Article XI, Section 2.

MR. SMYTHE: I move that we reconsider the election of Mr. Pratt, suspend the rules and elect him an honorary member.

MR. LAUGHRIDGE: I was the one who made that motion and I was under the impression that the old Constitution and By-Laws provided for such cases as that of Mr. Pratt. It was an oversight on my part. I did not look up the new Constitution and By-Laws in regard to this matter. The best way out of this now is to make a motion that the Committee on Law amend the Constitution.

THE PRESIDENT: There is a motion before the house.

Mr. Smythe's motion was carried.

MR. G. W. BENNETT: That motion was to suspend the rule and elect him. I would like to include Mr. Frank McManamy in that.

MR. LAUGHRIDGE: For the information of the members, I will read Article XVI: "No article or clause to the foregoing Constitution shall be altered, amended or repealed except at an annual meeting and then only by a two-thirds vote of the members present." I think the best way out of this is to amend the Constitution.

THE PRESIDENT: It has been moved and seconded that Mr. Frank McManamy be included. Carried.

THE PRESIDENT: I declare Mr. Pratt and Mr. McManamy honorary members of this Association.

MR. GOODWIN: It has been the will of this Association, and also the recommendation of the Law Committee, which was passed, to have our Secretary and Treasurer bonded. The law on this subject is very plain. The Executive Board should be the custodian of the bonds. Last year we came to the convention and found that the law had not been obeyed. This year I understand only the Secretary is bonded.

THE SECRETARY: I was bonded last year and the bond has been renewed for the new year.

MR. GOODWIN: It is very essential that the laws be carried out. If not, there is no reason for having them. I am satisfied that the Treasurer is all right; there is not a more honorable man of my acquaintance, and it is the same way with the Secretary, but, at the same time, it does not look as though we are doing business in a businesslike way. We don't know what is going to happen. We have a few hundred dollars in the Treasury and our affairs should be conducted in a businesslike way. I think the Executive Board should see that it is done.

MR. YOUNG: The reason the Executive Board did not act was because we were not certain as to what the new Constitution said on this subject. We did not have a copy.

MR. G. W. BENNETT: I beg to differ. The Secretary sent me a Constitution as well as every other member.

THE PRESIDENT: We will now have the report of the Executive Board.

REPORT OF THE EXECUTIVE COMMITTEE.

Minutes of the Special Meeting of the Executive Board of the Master Boiler Makers' Association Held at the Statler Hotel, Cleveland, O., October 9th, 1915.

The meeting was called to order by Chairman Nau at 9 o'clock A. M., the following members being present: Nau, Lucas, Sarver, Winterstein, Weldin, Young, Powers and Laughridge; also the following officers of the Association: President Greene and Fourth Vice-President Charles P. Patrick.

The reading of the minutes of the last meeting was dispensed with and the regular work of the board taken up and disposed of as follows: Expense bill of $1,787, presented by the Chairman for typewriting, stamps, etc. Motion by Winterstein, seconded by Lucas, that the bill be allowed and ordered paid. Carried.

A resolution was offered and duly carried approving of the system the Association Secretary used in handling the registration at the last convention and recommending that he use the same next year. Motion by Powers, seconded by Weldin, that the Board Secretary confer with the proper officers of the Western Railway Club with reference to the club holding their annual meeting so that it will not conflict with the Master Boiler Makers' Association meeting. Carried.

Motion by Weldin, seconded by Winterstein, that the request of the National Tube Co. for permission to give a moving picture illustration of the manufacturing of tubes be granted, providing that they confine their explanations to educational purposes only. Carried.

Motion by Winterstein, seconded by Lucas, that the President be requested to withdraw topic No. 1 of the 1916 Schedule. Carried.

Motion by Weldin, seconded by Powers, that a substitute for topic No. 1 be the "Best Method of Cleaning Superheat Tubes Both In and Out of Service." Carried.

Motion by Weldin, seconded by Lucas, that the Chairman appoint a committee to take the necessary preliminary steps in the matter of the Master Boiler Makers' Association co-operating with the railway organizations, whose aims and objects harmonize, in regard to holding annual meetings consecutively in the same city. Carried. Therefore the Chairman appointed the following committee: W. H. Laughridge, Chairman; Powers, Sarver and Chairman Nau, member ex-officio.

Correspondence from Mr. Lewis referred to the Secretary for disposition.

Motion made, seconded, and duly carried that the question of next meeting place be discussed. The Chairman then read the names of a

number of cities that had extended invitations, among them being Cleveland. After due discussion the Supply Men's Association were invited to join us in joint meeting, those in attendance consisting of Mr. David Champion, President; Mr. Steve Sullivan, Mr. B. E. D. Stafford, Mr. Parish, Mr. Sevey, Mr. Bateman and Mr. Slate. Mr. Champion extended a very cordial invitation in behalf of Cleveland, followed by Messrs. Sullivan, Bateman, Parish and Sevey. Mr. Slate, having canvassed the hotel situation, presented his findings. After some discussion the meeting recessed for lunch at the Hollenden Hotel.

Motion made and seconded and duly carried that flowers be sent to Mr. John Harthill, a member of the Association, who was ill at the Lakeside Hospital. The Chairman and Secretary were instructed to purchase them and send in the bill. The Chairman and Secretary carried out their instructions and sent $3 worth of flowers.

After lunch the Board decided to hold the next annual meeting at the Hollenden Hotel, Cleveland, O., on May 23, 24, 25 and 26, 1916. The meeting then adjourned to meet at the call of the Chairman.

W. H. LAUGHRIDGE, Secretary.

Special meeting of the Executive Board of the Master Boiler Makers' and Supply Men's Associations, held at the Hollenden Hotel, Cleveland, O., January 15th, 1916.

Those present were: Chairman Charles N. Nau, B. F. Sarver, Thomas F. Powers, Harry F. Weldin, W. H. Laughridge and Vice-President Charles P. Patrick of the Master Boiler Makers; President D. Champion, Mr. Slate, Mr. Bateman, Mr. Sullivan and Mr. Stafford of the Supply Men's Association.

The following business was transacted in joint meeting:

Final arrangements for the annual convention were made, after securing a written guarantee from Manager Thompson of the Hollenden Hotel, that in the event that the new addition to the hotel is not completed in time for the Convention that the management would place the Armory at the disposal of the Master Boiler Makers' and Supply Men's Associations free of all costs.

After which the Board of Master Boiler Makers convened and disposed of the following business:

Motion by Weldin, seconded by Sarver and duly carried, that notice be sent to all members immediately that it is imperative that they make hotel reservations at once, and in case they are unable to attend the convention to advise the hotel management to cancel same not less than one week prior to the convention. Also notify all members that there will be no change from the original arrangements and that this notice be sent a second time, 30 days from the first, these notices to be sent out by the Association Secretary.

Motion by Weldin, seconded by Sarver and duly carried, that the subject of an extension of time for the removal of caps on flexible staybolts be accepted and that the action of President Greene, in his appointment of committee, be ratified and recommend that Mr. Charles Patrick be added to the committee.

The Board then adjourned to meet at the call of the Chairman.

W. H. LAUGHRIDGE, Secretary Executive Board.

MR. LAUGHRIDGE: There appears to be a misunderstanding in regard to the increased expense and which the Board desires to explain. When our worthy Treasurer made his report he gave you an itemized account which explained all the expenses in detail. The name of H. D. Vought

appeared quite often as the recipient of various amounts, which is nothing unusual in the transaction of business matters, as the various bills for supplies were paid through our Secretary.

Some one having seen fit to criticise the method, the Board desired to investigate and failed to find any ground for complaint. One invoice for $356.49 covered numerous items, and after looking over the bill and having an explanation of the same by our worthy Secretary, it will be easily understood. This is an itemized account of the bill in question, $356.49 being the total amount. Someone started the story that this bill was for Constitution and By-Laws, but you will note that this was only one item in the invoice and the actual cost but only $24.

BILL NO. 15. AMOUNT, $256.49. COMPOSED OF THE FOLLOWING ITEMS.

Composition and press work, 700 copies Constitution and By-Laws.	$ 24.00
Binding 750 copies of Proceedings in cloth and stamping in White Leaf, 17c. per copy	127.50
Composition and press work and 700 copies	2.50
700 post cards	7.00
Express charges, 147 books at 16c	23.52
Postage on 230 books at 9c	20.70
Postage on 84 books at 11c	9.24
Postage on 249 books at 14c	34.86
Postage on 1 book at 17c	.17
Inserting, tieing, stamping and mailing	7.00
	$256.49

I will now give you some of the causes of the increased expenses over previous years. Last year a new Constitution and By-Laws was published and sent to all of the members. Also 171 copies of the Proceedings were bound in cloth and sent out gratis as authorized by the convention. You will find upon inquiry that the postage on our Proceedings has increased very materially, and also the cost of stationery and printing. As there seems to be a misunderstanding with a great many of our members in regard to our contract with the Secretary, I wish to state for the information of all that 10 years ago, when we met at this hotel, and consolidated the two Associations, we entered into a contract with the Secretary to pay him 75 cents per capita for every member in good standing, he to furnish the Proceedings to each member in good standing without cost, and which he has done.

The revenue from the sale of the Proceedings and all advertising matter that he could get was to go to the Secretary himself, except 25 cents per copy, which was to go to the Association. All engravings or cuts wanted for the Proceedings were to be paid for by the Association.

When our Secretary entered into this contract he had some revenue from the sale of extra copies of the Proceedings, but since the Association has been sending out so many gratuitous copies, both the Secretary and the Association have lost this revenue.

I would also call your attention to the fact that this Association has an office at 95 Liberty St., New York City, N. Y., where records are kept in a fireproof safe and where all members are always welcome. For this the Association does not pay one penny and I think that it should be congratulated on being able to get so much for so little. I trust, therefore, if any member has any further criticisms to make, they will withhold them until they are reliably informed in the matter.

As to the Executive Board, I believe they have done everything that anybody could to keep the working of the Association within its means and the balance in the Treasurer's hands shows that they have succeeded admirably. Your Executive Board, therefore, feels that they should not be unjustly criticised. They appreciate the honor accorded them and pay their own expenses, and I can assure you that the Board can be trusted implicitly. They are always on guard and all transactions are placed before you for ratification. I hope this explanation will be sufficient to allay any adverse criticism.

I will now read you the minutes of the final meeting of the Executive Board.

FINAL SESSION OF THE EXECUTIVE BOARD.

The Hollenden Hotel,
Cleveland, O., May 22, 1916.

The Executive Board convened at the Hollenden Hotel at 3 o'clock P. M. The meeting was called to order by Chairman Nau. The reading of the minutes of the previous meeting was dispensed with.

The following members were present: C. N. Nau, John Winterstein, H. F. Weldin, A. N. Lucas, T. F. Powers and W. H. Laughridge.

The Chairman stated that the meeting was called to transact the regular business of the Board. After a general discussion on various subjects relative to the best interests of the Association the following business was disposed of.

Motion by H. F .Weldin, seconded by Powers, that the committee appointed to confer with committees of similar organizations with reference to holding annual meetings of the Association consecutively in the same city be retained. Carried.

Motion by T. F. Powers, seconded by A. N. Lucas, that J. L. Roach be dropped from membership. Carried.

Communication from Mrs. B. F. Sarver advising of the serious illness of Mr. B. F. Sarver, a member of the Board, was read and a motion by H. F. Weldin, seconded by T. F. Powers, that the Secretary wire our regrets and extend our sympathies to Mr. and Mrs. Sarver, carried.

Motion made and duly seconded that the Local Committee of arrangements be authorized to adjust all complaints in regard to hotel accommodations. Carried.

Motion made and duly seconded that the paper by Mr. L. R. Pyle,

which was read at the Fuel Convention at Chicago recently, be read to the convention if the members so desired and time would permit. Carried.

The Board then recessed until 2 o'clock P. M., Tuesday, May 24.

Tuesday, May 24, 1916.

The Board resumed its session, the following members being present: C. N. Nau, H. F Weldin, A. N. Lucas, T. F. Powers, E. W. Young, John Winterstein and W. H. Laughridge

The financial condition of the Association was taken up and discussed from its various standpoints, and after a general threshing out of this very important subject, the Board decided to recommend some curtailing, the first step being a motion by H. F. Weldin, seconded by A. N. Lucas, that the Board recommend the discontinuance of sending out free copies of the Proceedings. Carried.

Motion made and duly seconded that the Association discontinue having the proceedings bound in cloth. Motion lost.

Motion made and duly seconded that the increase in running expenses for the year just closed be explained to the Association. Carried.

The following bills were present and ordered paid:

Bill of W. H. Laughridge for $3 to reimburse for flowers sent to a sick member.

Bill of Chairman Nau for typewriting, $7.50.

Bill of President Greene for expense of his office, $30.

Motion by Weldin, seconded by T. F. Powers, that the Board recommend that the Association create the office of Chaplain and that it be an elective one. Carried.

After classifying and approving 61 applications for membership the Board adjourned.

W. H. LAUGHRIDGE, Secretary.

MR. GOODWIN: No doubt, from what he has said, Mr. Laughridge is under the impression that somebody is censuring the Executive Board. Far be it from anyone to do that. I am sure everyone else feels as I do. We like to have explanations made to the convention, and for you to investigate bills. It is no disrespect to the man that the bill is made against or the man who contracts it. We know that the Executive Committee is doing everything in their power to make a success of this Association, and we don't want you to feel that you are not doing your duty, but you must not be so thin-skinned as to resent any suggestions that are made or any complaints that come in of any negligence on your part. The point that I raised this morning with reference to the bonding of the officers is undoubtedly one we have a right to make. This matter has been discussed at two or three conventions, and if you fail to attend to it, that is your own lookout. I don't want you to think that I mean anything personal about it, but as long as you neglect anything and we find fault with it, I, for one, am going to express myself in regard to it.

MR. PATRICK: Mr. Goodwin is perfectly right. It is simply a matter of business. While I am not a member of the Executive Board I have had an opportunity in the last several months to attend their

meetings. I don't know of a body of men who work more faithfully They produced the goods and are working when you don't know anything about it. I have not the slightest criticism at all to make, and I don't believe there is any just criticism which anyone can offer about them.

MR. LAUGHRIDGE: I heartily concur with Mr. Goodwin and Mr. Patrick. I think we should be very businesslike. That is what we are here for, and I think everything should be attended to in a businesslike way.

MR. GRAY: There seems to be some misunderstanding and criticism of one thing or another among the members, and I suppose I am responsible for all of it. There is no blame on the Secretary, or the Executive Board or any officer of this Association that I know of, and I believe that I have been in about as close touch with them as anybody. Our Association is growing and it is necessary for us to spend more money than we have heretofore. The boys all felt pretty good in Chicago and thought that we were branching out and could do more in an educational line, and bring ourselves to the attention of the people in the country, the mechanical men. No money has been spend that was not authorized or otherwise than in a legitimate way. The bills ran a little heavier than we thought they would. While we have a comfortable balance in the treasury, while our expenses exceeded our income this year, we thought it was time for the members of the Association and everybody concerned to know it. That was why I made a detailed report this year of the expenses. Only one man violated that law, and that is your Treasurer. In some way or another he failed to bond himself. Otherwise the Association has received every cent turned over to him, and my sole object in calling this matter to the attention of the Association was that they could keep their expenses and income on a parity. We don't need a big balance. We should not have one. We should spend the money, but at the same time, if we spend more than we take in, it does not require a mathematician to tell where we are going to bring up. I made a fair and square statement so that every member would know what we were doing in the financial line. That is all there is to it. Nobody has been doing any crooked work and the only law neglected was the one your treasurer violated.

MR. WINTERSTEIN: One little point was forgotten by Mr. Laughridge. After the Treasurer's report was read at the opening session, there was a great deal of criticism of the Board. The members wanted to know about that big item, and that was something with which the Board had nothing to do. The Association last year authorized the printing of a new Constitution and By-Laws, and also the sending of free copies of the Proceedings to Superintendents of Motive Power. The Board had

nothing to do with that. They simply carried out the instructions of the Association. Now as long as the hammer is out and the Law Committee is making new laws, the Board will be in the same position this next year. I guess we will have to get new copies of the Constitution and By-Laws if the law committee makes more changes. I want to know why the Law Committee don't get up a good Constitution and By-Laws and save all that expense?

MR. WELDIN: I think every member of the Association should have at heart the welfare of the Association. They should come to the members of the Executive Committee if they see anything wrong, and I am referring to the older members, Mr. Conrath and Mr. Bennett. Some of you who have been in the Association for a long time should come to us if we are not doing right. We will be only too glad to receive any suggestion and act on it, because we know you have been in the harness for a long time.

MR. PATRICK: I am going to say what I feel, and I believe I feel just like every other man here, that the reason our Treasurer has been perpetuated in this office is because of what he said today—the attitude that he takes. He wants to straighten us out, and give us the proper information.

MR. NAU: Mr. Gray has just said that he was the only one who had violated the law. I want to correct him and tell you that it is the Chairman of the Executive Board who has violated the law, and I want to apologize to the Association. It was not done intentionally and I can assure you that it won't happen in the future. I thank you.

MR. CONRATH: I feel it is my duty to say a few words in regard to this matter, especially when any one attacks my friend Gray. We have had him for Treasurer ever since the two organizations were consolidated, and long before in one of the other Associations. When it comes to economy and honesty, I don't know where you would find his equal. (Applause.) He makes a report that is reliable in every shape, manner and form. Possibly he has not detailed it as much as you would like it, but I would vouch for its correctness at any time. A few mistakes may have been made by the Executive Board. I have not seen them myself, but, if it is so, I want to say for the Executive Board that it is one of the best that has ever served. I have served on the Executive Board myself in the past, but I believe that this is the best Executive Board that we have ever had. (Applause.) I see no reason for finding fault, gentlemen. There isn't any, and as far as the By-Laws are concerned, I think they can be improved on from time to time. I was present when the Constitution was drafted. We sat for three hours in a room in this very hotel and drafted the Constitution and By-Laws. We were inex-

perienced in this line and we wish to see them improved from time to time. Let us take the recommendations of the Committee on Law and if anything has been overlooked, all we have to do is to call attention to it. I believe that everybody here is serving this Association to the best of their ability and we can feel assured that all of the officers will take care of this Association at all times.

MR. G. W. BENNETT: I don't know who found any fault. It was rumored that the printing of the Constitution cost $256.49. That is all the complaint I heard and I don't see why there is so much talk about this. It is merely a mistake.

MR. A. N. LUCAS: I have not heard a member say a word about it. I think the Executive Board has brought this upon themselves. Somebody might have said, "Where is all the money going?" but there was no complaint against the Executive Board. I have talked to a number of men and I have not heard a word. We have been getting along so well, and our money taken care of this year, just like any other year, that nobody has brought any complaint against the Treasurer's report, not a soul.

MR. LAUGHRIDGE: I heartily agree, as I know the entire Board will, with what Mr. Conrath has said in regard to our worthy Treasurer, but I must take exception to what Mr. Conrath said when he stated that an attack had been made on Mr. Gray. We hold Mr. Gray in the highest esteem and the reason I brought out the point of his making an itemized statement at the opening session was that a great many members did not understand thoroughly and their judgment was based on incorrect information. Mr. Gray's report was fine; the Executive Board appreciates it.

MR. CONRATH: I think the report will show them where they are at.

MR. GRAY: Mr. Lucas said that some of the members wanted to know where the money had gone. Not one of you has any occasion to want to know, because I told you where it was all going; that was exactly why I read the report. Why I gave you an itemized report, and nobody made any complaint then. When you get the proceedings and the report you will find where every dollar went. (Applause.)

THE PRESIDENT: I don't see any need of this argument at all. Mr. Gray did right in giving an itemized statement, and if there is not enough money in the treasury the members should be taxed a little more; another dollar should be put on, so that we can meet all expenses. I think two dollars is not quite enough for dues. We are to become a big organization, we want to be somebody, we require a Constitution that is

right up to the mark and in first-class order, and I think all this argument is foolish. Gentlemen, you have heard the report of the Executive Committee, what is your pleasure.

Upon motion the report was received and approved.

REPORT OF THE COMMITTEE ON TOPICS.

THE PRESIDENT: We will now hear from the Chairman of the Topic Committee, Mr. Raps.

MR. RAPS: In compiling the topics for the next annual convention, your committee has endeavored to get up a list that has not been handled at any of the preceding conventions. This was quite an undertaking as the available subjectes have been almost exhausted. No less than 12 subjects have been discussed at each of the preceeding meetings. We tabulated a list of all that have been discussed at the various conventions of the organization. Some of the topics we propose have been divided into sections in order to bring out more discussion and to get more information from the various railroads. Our recommendations are as follows

TOPICS FOR 1917 CONVENTION.

1. Proper method of threading radial stays and tapping out holes in boiler for same. Is it necessary to give radial stays the same lead as the tap with which the holes were tapped?

2. Which is the better method of drilling tell-tale holes, before or after application of bolts? Which is the better method of drilling for either case? What is best style of drill for opening up tell-tale hole in old staybolts? Does it pay to use high speed steel for this purpose? What is best lubricant for the drill?

3. Effect of proper upkeep of front and draft appliances on fuel economy. Method used in determining proper design for various classes of locomotives.

4. Best method of banding superheater units and kind of tools used for grinding ball joints of superheater units and headers. How can wearing away of superheater unit return bends be overcome.

5. The merit or demerit of the various patented methods of applying boiler tubes, compared with present method of application.

6. What is the best type of wash out plug, arch tube plug or cap to be used in order to overcome leaking, when boiler is under pressure? Kind of thread, number of threads per one inch and taper per foot?

7. Which firebox steel gives the best results from actual service test, steel having a tensile strength of from 48.000 to 58.000 pounds or 55,000 to 65,000 pounds per square inch?

8. What is the best method for scaling superheater flues in the boiler? What is the best method of rattling flues? What is the best method of handling flues in and out of the rattler? How many revolutions per minute should the rattler make for two inch and five and three-eighths inch flues? Describe method for safe ending superheater flues.

9. What pressure should be used on hydraulic riveters for various size rivets? For what purpose does it pay to use power riveters of the smaller sizes? What degree of cone head rivet set gives the best results used in conjunction with hydraulic riveters and long stroke riveting hammer?

10. What is the best style grate for bituminous coal? Where should the dump grate be located; (a) in road engines, (b) in switch engines. What should be the percentage of opening in grates? What should be the percentage of draft opening in ash pans, compared with area of firebox?

11. What should be the minimum distance between grates and lower bend of arch tubes for the different classes of locomotives? What is the proper distance from door sheet to brick arch and from crown sheet to brick arch for the various classes of locomotives?

12. What is the best method of bracing locomotive tenders? Describe methods used.

13. Oxy-acetylene welding.

14. Electric welding.

15. Topics for 1918 Convention.

16. Law.

JOHN F. RAPS,
C. F. PETSINGER,
H. W. SMITH,
P. E. COSGROVE,
M. J. GUIRY,
Committee.

THE PRESIDENT: Gentlemen, you have heard the report, what is your pleasure?

MR. GOODWIN: I move the report be received and referred to the incoming president. Carried.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

THE PRESIDENT: Next will be the report of the Resolutions Committee. Mr. Hodges, Chairman.

Your Committee on Resolutions begs leave to submit the following for your consideration with a recommendation for its adoption:

In the closing hous of its Tenth Annual Convention, in the city of Cleveland, the Master Boiler Makers' Association experiences an unusual sense of pleasure in spreading upon the record of its Official Proceedings an expression testifying to the highest appreciation of all that has made our brief sojourn here so pleasant, profitable and memorable.

We acknowledge with grateful hearts the courteous attention and thoughtful consideration extended to us by public officials, business men and all others who have so kindly anticipated every wish, who have met every possible expectation and have done so much to command our admiration and satisfaction.

We shall all remember the city of Cleveland ("The Queen City of the Lakes," and the sixth city of the United States, whose slogan is one million in 1920) with pleasure, for it was here half a decade ago that the two old associations were happily amalgamated into one grand organization, which event made possible the success of the Master Boiler Makers' Association of to-day, and conceded to be one of the leading, as well as the most educational organizations of the country.

We have listened with the keenest enjoyment to the hum of industry within the environs of the city of Cleveland, which tells of the activity rightly directed for prosperity, contentment and happiness, and diversified experiences while here have made us the happy recipients of that lavish hospitality which exemplifies the splendid character of her people and the progressive spirit of her business men. Embodying as she does these splendid characteristics will compel recognition and advancement equally, if not surpassing, the most advanced cities of this country.

Our brief sojourn in the city of Cleveland has been inspiring in the extreme, the influence of which will tend to strengthen and encourage through life's opposing forces, and doubtless will prove a sweet reminiscence of old age.

In recognition of the encouragement and helpfulness thus obtained, we are profoundly grateful and wish to extend an expression of our acknowledgements to those who have contributed their part to this end. In this connection we wish to mention Mr. J. H. Smythe, Past President of the Master Boiler Makers' Association, who at the opening of the convention invoked the Divine Blessing upon the assembly, the cordial welcome and greeting extended by the Hon. Harry L. Davis, Mayor of Cleveland, the excellent papers of Mr. D. R. MacBain, Superintendent of Motive Power of the New York Central, Mr. Frank MacManamy, Chief Federal Boiler Inspector, Mr. J. T. Carroll, Assistant General Superintendent of Motive Power of the B. & O., and for the privilege extended us by the New York Central officials to visit the Collinwood shops.

We are particularly indebted to the Underwood Typewriter for providing the Secretary's headquarters with one of its latest machines, and by this courtesy has so materially facilitated the work requiring attention.

We find occasion to also refer with pleasure to the Hotel Hollenden and its management in contributing to our comfort and making our visit agreeable.

Once more it is fitting that we acknowledge our special indebtedness to members of the Boiler Maker Supply Men's Association for the gratifying and successful manner in which they provided creature comforts and social divertisement that have been a source of relief and pleasure.

That the importance of the position our Association occupies is recognized, and that the work we do is valued, has been seen again in the liberal space and close attention accorded our Proceedings by the daily newspapers of Cleveland. We desire to thank them very heartily for this mark of their consideration and with equal reason accord a note of praise to the technical press, especially the Boiler Maker, Railway Age Gazette, the Mechanical Engineer and Railway Journal and their representatives for the liberal treatment they have always given us.

A matter of pride and gratification is the constant stability and increasing growth of the Women's Auxiliary, which, through the attendance of its members, is a source of lasting sunshine, zest and happiness at our conventions. We have to repeat what has been said in this connection on several occasions that "Woman is man's radiant and inspiring companion and counselor, and so long as she keeps by his side, he is assured of protection, guidance, and whatever measure of success he obtains by honest, conscientious effort."

Finally, that our work may have that graceful finish which a rightful and just recognition of merit insures, we make special acknowledgment to the officers of our Association, whose careful and efficient administration of its affairs during the past year has been prompted by wisdom and regard for its greatest welfare. The notable success of this convention is its crowning feature and their best reward is in the consciousness of

duty well performed and which commands the respect and commendation of their fellow members.

A. R. HODGES, Chairman
JOHN HARTHILL
CHARLES P. PATRICK

THE PRESIDENT: You have heard the report the Resolutions Committee, what is your pleasure?

MR. LAUGHRIDGE: I move that the report be received and a rising vote of thanks be given the committee. Carried.

THE PRESIDENT: The next order of business will be the report of the Auditing Committee.

REPORT OF THE AUDITING COMMITTEE.

Your Auditing Committee have examined the accounts and books of the Secretary and the Treasurer and respectfully submit the following report.

We find a difference of $5 between the amount reported by the Secretary and that of the Treasurer, which is due to a member making good a check received with his application and payment refused after same was forwarded to the Treasurer. It was returned to the Secretary, upon whose books it was already credited, and that officer did not get the new check until several months ago. It then went on the books of the Treasurer for the first time and so was included in his annual report. It had been shown in a former annual report of the Secretary.

With the above exception we find that the annual reports as submitted by your Secretary and Treasurer at your convention are correct.

Your Auditing Committee of 1915 recommended that a voucher be adopted so that the same could be used as a bank check. We are pleased to report that this voucher system has been in use during the past year, and we find that this method is a decided improvement over that formerly employed, in that it expedited the checking of the books and accounts of the association.

We wish to express our high appreciation of the efficient service rendered your association by the Secretary and the Treasurer in the past year as disclosed by our examination of their accounts.

Respectfully submitted,
J. H. SMYTHE
C. N. NAU
G. W. BENNETT

THE PRESIDENT: You have heard the report of the Auditing Committee, what disposition do you wish to make of it?

MR. LAUGHRIDGE: I move the report be received and a vote of thanks extended to the Committee. Carried.

(MR. D. A. LUCAS in the Chair.)

VICE-PRESIDENT LUCAS: We will now have the report of the Committee on President's Address.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

Your committee beg leave to report that the thoughtful and comprehensive point of view shown by the President in his annual address to the convention was but a reflex of the broad, intelligent and conscientious administration he has given the Association during the past year.

In all this, as in many other ways, it is unnecessary to enumerate that he has added lustre to the unblemished record established as a member and officer of the Association, and furnished an example which not only his successors may well emulate, but every member of the Association as well.

It is a demonstration of the value and reward of unfailing personal loyalty, official devotion to duty, and that measure of kindly courtesy and consideration which wins and cements friendships lasting the full period of human life.

MR. LAUGHRIDGE: I move the report be received and a vote of thanks extended to the committee. Carried.

(PRESIDENT GREENE in the Chair.)

THE PRESIDENT: We will now have the report of the Committee on Memorials.

THE SECRETARY: The Committee on Memorials has not been appointed. It has to be very carefully selected and the request is made that the convention consent to this committee filing their report after you have adjourned, so it may be published in the proceedings of the convention.

MR. LAUGHRIDGE: I move that the incoming President be authorized to O. K. the report of this committee. Carried.

ELECTION OF OFFICERS.

THE PRESIDENT: Election of officers is in order.

MR. LAUGHRIDGE: Before the election of officers, permit me to say that I have been associated with a certain gentleman in this Association for 35 years and have always found him true to his convictions and his fellow men. He needs no introduction. I take great pleasure in placing in nomination for Chaplain of this organization Past President J. H. Smythe.

MR. WINTERSTEEN: I second the motion.

MR. A. N. LUCAS: I move that the Secretary be instructed to cast the ballot of this Association for Mr. Smythe as Chaplain. Carried.

The President appointed A. N. Lucas, J. T. Goodwin and P. J.

Conrath tellers. The ballot was cast in accordance with the motion and Mr. Smythe declared elected.

MR. SMYTHE: Twenty-seven years ago I gave my heart to God and I told him then I would never deny Him. If you men have confidence enough to make me your Chaplain, I am at your service. (Applause.)

MR. G. W. BENNETT: I believe I am in order now and I ask the unanimous consent of this Association to cast one ballot for the office of President, that ballot to bear the name of Mr. D. A. Lucas.

MR. YOUNG: I second the motion.

The motion being carried, the ballot was cast and Mr. D. A. Lucas declared President.

MR. D. A. LUCAS: I certainly consider this a great honor and will do everything in my power to maintain the standard of the Association, and I will try to give you good, efficient service as President and thank you for this honor from the bottom of my heart. (Applause.)

THE SECRETARY: I waited in connection with this office to see whether any of the members of the Association would appreciate the fact that for the first time in the history of the Association, you have placed at its head a gentleman who is entitled to write "Honorable" before his name. I have the honor to introduce the Honorable Mayor of Havelock, Neb. (Applause.)

THE PRESIDENT: We will now proceed to nominations for First Vice-President.

MR. SMYTHE: I have the pleasure of placing in nomination for First Vice-President Mr. John B. Tate. Having had the privilege of naming him for advancement at every convention I wish to also place him in nomination this year. He does not need any recommendation. I also move that the Secretary be instructed to cast the ballot of the Association for Mr. Tate.

The motion was carried and the ballot cast accordingly.

MR. TATE: I cannot express my appreciation in words, but I wish to have the sympathy and well wishes of all the members of the Association that I may be of help to our President during the coming year and that I may be able to assist the Association in anything that may come before it. I thank you. (Applause.)

THE PRESIDENT: Nominations are now in order for Second Vice-President.

MR. YOUNG: It gives me great pleasure to nominate a man who needs no introduction. I place in nomination Mr. Charles P. Patrick for Second Vice-President and I move the Secretary be instructed to cast one ballot.

Motion seconded and carried and the ballot cast accordingly.

THE PRESIDENT: Mr. Patrick, will you accept?

MR. PATRICK: I should say so. I appreciate the honor you have conferred upon me. I expected it, and if I live two years longer, I will reach the highest office. If you continue to advance me, if I conduct myself in the proper manner and become President of this Association, I will endeavor to do you honor. (Applause.)

THE PRESIDENT: Nominations are now in order for Third Vice-President.

MR. KELLY: I take pleasure in placing in nomination Mr. Thomas Lewis.

MR. A. N. LUCAS: I second the motion and move the Secretary be instructed to cast one ballot.

The motion was carried and the ballot cast accordingly.

MR. LEWIS: My feelings will not permit me to say what I would like to. I assure you one and all that I have the interest of this Association at heart. I can remember when this Association met in a very small room. I can remember when our friend Conrath came all the way from St. Louis to plead for the amalgamation of the two associations. We have evidences here that we are amalgamated, and as we are now at a period when oxy-acetylene and electric processes are used to weld the boiler together, I believe this Association is living in an age when we, as men, are welded together in such a way as we never were before. I thank you for the honor you have conferred upon me. (Applause.)

THE PRESIDENT: Nominations are now in order for Fourth Vice-President.

MR. HODGES: I place in nomination Mr. T. P. Madden for Fourth Vice-President of this Association. He needs no introduction for he is a well known character, possessing broad experience and an enviable

reputation. He will do honor to this organization and render great service.

MR. HARTHILL: I place in nomination Mr. H. F. Weldin for Fourth Vice-President.

MR. LUCAS: I move the nominations be closed and we proceed to ballot for the candidates. Carried.

MR. LAUGHRIDGE: Mr. President, while the tellers are collecting the ballots I wish to announce that we have received a reply from Mrs. Sarver to our message and she reports Mr. Sarver is worse. He is very seriously ill.

The ballot for Fourth Vice-President resulted as follows:

T. P. Madden	78
H. F. Weldin	33
Total	111

THE PRESIDENT: Mr. Madden having received a majority of the votes cast is declared Fourth Vice-President.

MR. MADDEN: Thanking you for the honor you have conferred upon me, I assure you that I will do my utmost to advance the good work of this Association. I wish to thank you for the confidence you have placed in me. (Applause.)

THE PRESIDENT: Nominations are now in order for Fifth Vice-President.

MR. BENNETT: I place in nomination a member of this Association who has been a member of the Executive Board for six years, and it seems to me he ought to receive some consideration. I take pleasure in naming Mr. E. W. Young for Fifth Vice-President.

MR. PATRICK: I was trying to get the floor to nominate Mr. Young. I don't know whether I am in order, but I ask for a special privilege if I am not. Mr. Young has been a member of the Executive Board for years and he has been nominating me for a Vice-Presidency every step. That is not why I am nominating him. I want to second his nomination because I believe he is a good man, and when he gets to first place he will make a good President. Therefore, I am pleased to second Mr. Bennett's nomination of Mr. Young.

MR. HEMPEL: I desire to place in nomination a gentleman who has served us on the Executive Board and whose term is about to expire, but he has not as yet tired of working for us. I nominate Mr. C. N. Nau.

MR. LAUGHRIDGE: I place in nomination Mr. Harry F. Weldin.

MR. GRAY: I place in nomination a man who has been connected with the Association for a long while, Mr. James Crombie.

MR. A. N. LUCAS: I move the nominations be closed. Carried.

MR. D. A. LUCAS: I move that after the ballots are counted, if there is no choice, the nominee receiving the least number of votes be dropped. Carried.

The ballot was taken and resulted as follows:

Mr. Young	67
Mr. Weldin	13
Mr. Nau	25
Mr. Crombie	3
Total	108

THE SECRETARY: Mr. Young has received a majority of all the ballots cast. (Applause.)

MR. GOODWIN: I think the opportunity should be given to some of the men who were nominated to make a motion that Mr. Young be elected unanimously.

MR. NAU: I move that the election of Mr. Young be made unanimous. Carried.

MR. YOUNG: I am not going to make a speech. All the speeches that have been necessary have been made. I appreciate very much what you have done here this morning and I want to thank you one and all from the bottom of my heart. You will always find me on the job.

MR. WELDIN: I was not in the room when the ballot was taken for Fourth Vice-President and I would like to move that Mr. Madden's election be made unanimous. Carried.

(MR. D. A. LUCAS in the Chair.)

VICE-PRESIDENT LUCAS: Gentlemen, the next order of business is the election of a Secretary.

PRESIDENT GREENE: Gentlemen, I wish to place in nomination a man who has been with this Association for a number of years—a man who has certainly been a credit to it and every one of us. He has certainly been a help to me in the past year and I think this Association surely is

honored by having such a man as Secretary. I place in nomination Mr. Harry D. Vought.

MR. A. N. LUCAS: I move the nominations be closed, and that the tellers be instructed to cast one ballot for the election of Mr. Vought. Carried, and the ballot cast accordingly.

MR. VOUGHT: I am proud to be not only with you but one of you. I thank you. (Applause.)

(PRESIDENT GREENE in the Chair.)

THE PRESIDENT: The next order of business is the election of your Treasurer.

MR. G. W. BENNETT: I have the honor of being a member of the Law Committee. At our recent meeting we were considering the insertion of a clause whereby Mr. Gray would be made our Treasurer for life, but we have not done so yet. Consequently I ask the unanimous consent of this Association to cast one ballot for the office of Treasurer, and that ballot to bear the name of Frank Gray.

MR. GRAY: I think the position of Treasurer has stayed in one place a little too long.

THE PRESIDENT: You are out or order.

Mr. Gray's nomination was seconded and the Secretary cast in accordance with instructions the ballot for his election.

MR. PATRICK: I would like to hear from Mr. Gray. He intended to say something and he has a right to the floor. If he wants to decline the nomination I think he ought to be given the privilege to do so.

THE PRESIDENT: Mr. Frank Gray, you have been re-elected Treasurer. Do you accept?

MR. GRAY: I appreciate very much the honor of holding office in this Association because it is a good Association. It is composed of men with whom I am proud to be placed, but I would like to see another man in the office. I don't approve of life positions and a number of men in the Association ought to have a chance. It should not be necessary for a man to have to wait for this place until some other fellow dies. I have tried to administer my office in the best way, but I think other men are competent and would be glad to do the work. If the rest of you don't look at it in that way I suppose I will have to serve or just

resign and let the Executive Committee appoint somebody else; but so long as I hold the office I will administer it to the best of my ability. (Applause.)

MR. GOODWIN: I am very glad to see Mr. Gray accept the office of Treasurer and I am satisfied that everyone in the Association joins me in this expression. I know there is much work attached to the office and I heard that he contemplated asking the convention not to re-elect him. It is gratifying that he has consented to take the position again.

THE PRESIDENT: The next order of business will be the election of three members of the Executive Board. The retiring members are Messrs. Young, Nau and Lindner.

MR. WANDBERG: I place before you the nomination of a man who has been with us since the infancy of this Association and who has attended every meeting. While he has never taken an active part he has always been with us. I nominate Mr. A. C. Dittrich, of the Soo Line.

MR. WINTERSTEEN: The Executive Board works off and on during the year and not only while they are here. I place in nomination a man who has worked hard on a couple of committees, Mr. W. J. Murphy.

MR. POWERS: I nominate a young man who has attended most of these conventions for the last six or seven years and who is at the head of a boiler department of one of the largest railroads in the country—Mr. John F. Raps.

MR. GOODWIN: Please permit me to call your attention to a gentleman from a section of this country that has no representation—a section that would certainly appreciate anything we did for them. I have in mind a man who has been one of the most active members in committee work, as much so as anyone in the Association. He is able, capable, a thorough mechanic and has as good a shop as you will find in the south. I think the southern section of this country should have a representative officer, should have a member on the Executive Board. I, therefore, place in nomination a man who will serve us well—Mr. L. M. Stewart of the Atlantic Coast Line, who is located at Waycross, Ga., right near the Florida line. His section of the country is asking for recognition. I am sure you will come to their relief and put Mr. Stewart on the Board. He is perfectly qualified and will make you a good officer.

MR. LAUGHRIDGE: I nominate for member of the Executive Board one of the most ardent workers of this Association. He has been a member of the local committee in Cleveland and he needs no introduction. We never have a session that he is not on the job. I place in nomination Mr. John Harthill of the Lake Shore.

MR. PATRICK: I may not be in order, but I want to second a nomination that was made a few minutes ago. I feel as Mr. Goodwin does that there is one section of the country which has not proper representation. I don't say that because I am a Georgia cracker, but because I know the man, so I second the nomination of Mr. Stewart.

MR. YOUNG: I nominate Mr. Crombie.

MR. JOHNSON: It is my pleasure to nominate Mr. Nau.

MR. D. A. LUCAS: I nominate Mr. B. Wulle of the Big Four Shops.

MR. POWERS: I move the nominations be closed. Carried.

MR. WINTERSTEEN: I move that the three candidates having the highest votes be elected.

THE SECRETARY: Your rule at all former elections has been that if a second ballot is necessary, candidates having the three lowest votes shall be dropped; also that you vote for three members on one ballot.

THE SECRETARY: The President desires the Secretary to announce that a meeting of the new and old Executive Boards will be held in the adjoining room immediately after the adjournment of this session and the attendance of all the members is desired.

The ballot for three members of the Executive Board resulted as follows:

Dittrich	7
Murphy	25
Raps	40
Stewart	62
Harthill	45
Crombie	6
Nau	30
Wulle	6
Total	221

A second ballot was then taken with the following result:

Stewart	58
Raps	45
Harthill	45
Nau	21
Total	169

THE SECRETARY: The three highest are Messrs. Stewart, Raps and Harthill. (Applause.)

THE PRESIDENT: Messrs. Harthill, Raps and Stewart, receiving the highest number of votes, are duly elected members of the Executive Board for three years each. Announcements are now in order.

MR. CONRATH: Several members while at the coast last summer visited Mr. Charles F. Lape and he expressed a desire to be taken off the list of active members and be placed on the honorary list of our Association. Owing to his home being so far away and his advanced age, he cannot attend the conventions, but he wishes to be one of us at all times. Therefore, I move that Mr. Lape be placed on the honorary list. Carried.

THE PRESIDENT: Before the adjournment of the convention I want to thank everyone for the support given me during the past year—Secretary Vought, Frank Gray and all the members of the Executive Board, as well as the various committees. I know it has been a big boost for the whole Association.

On motion, the convention then adjourned.

An Appreciation

JAMES D. FARASEY

Died January 25th, 1916

At Cleveland, Ohio

WHEREAS: Almighty God, in His wisdom, has called to his eternal home our dearly beloved friend, James D. Farasey, Secretary of the American Boiler Manufacturers' Association, and

WHEREAS: His life as husband, father and friend was an inspiring example of earnest, honest endeavor, of constancy, loyalty and manly worth, and

WHEREAS: During his many years as the official representative of the American Boiler Manufacturers' Association to our deliberations his presence was a pleasure, his judgment sound, his efforts for the promotion of our aims and ideals always active and earnest, and his loyalty unswerving; be it

RESOLVED. That we extend to his bereaved family our most sincere sympathy in this their irreparable loss which we count also as our own, and recommend them in their great sorrow to Him Who has asked us to lay our sorrows at His feet, and Who has promised us a reunion and an abiding place in Eternity; be it also

RESOLVED: That as a lasting testimonial of our sorrow and esteem, a copy of these resolutions appear in the Official Proceedings of our Cleveland Convention, and be it further

RESOLVED: That a copy of this Memorial be sent to the family of our dearly beloved friend as a token of our sorrow and love for him whose loss we most sincerely feel.

GEORGE N. RILEY, Chairman
E. W. YOUNG
JOHN WINTERSTEEN,
Committee

In Memory

of the Late

P. F. FLAVIN

As it has pleased the Almighty in His wisdom to call to his eternal reward our highly esteemed friend and co-worker. P. F. Flavin, this Association has lost a very active member whose advice was often sought and willingly given, and who will long be held in affectionate remembrance by the members of this Association, and his wife is deprived of a most loving and devoted husband; therefore be it

RESOLVED: That the Master Boiler Makers in convention assembled hereby express their heartfelt sympathy to the bereaved wife and loved ones in their hour of great sorrow.

RESOLVED: That a copy of these resolutions be sent to the sorrowing wife and printed in the official proceedings of this convention.

P. J. CONRATH, Chairman
JOHN C. CAMPBELL
T. P. MADDEN
Committee

New Members Enrolled During 1915-16

ACTIVE.

Bayer, Fred, B. M. F., P. C. C. & St. L. Ry. Co., 410 St. Clair Ave., Columbus, O.
Boaman, John P., Asst. B. M. F., Philadelphia & Reading Ry. Co., 425 Spruce St., Reading, Pa.
Bolman, H. E., Asst. F. B. M., C. & O. & I. Ry., 481 W. Main St., Peru, Ind.
Browning, C., F. B. M., Grand Trunk R. R., 53 Cherry St., Battle Creek, Mich.
Bryant, G., C. N. O. & T. P. R. R., 101 Park Ave., Ludlow, Ky.
Campbell, Jesse C., B. F., Missouri, Kansas & Texas Ry. Co., 622 W. Owing St., Denison, Tex.
Cantwell, Edward, B. F., Big Four, Bellefontaine, O.
Carder, J. F., F. B. M., St. L. S. F. & T. R. R. (Frisco), 1016 E. Williams, Sherman, Tex.
Cook, Wm., B. M. F., Pacific Coast Ry. Co., 611 Bright St., Seattle, Wash.
Cook, Wm., B. Insp., at Chicago Shops, Chicago, Rock Island & Pacific Ry. Co., 6930 Michigan Ave., Chicago, Ill.
Dugan, Thomas P., F. B. M., The Delaware & Hudson Co., 152 Hudson Ave., Green Island, N. Y.
Erwin, Charles E., F. B. M., Grand Trunk R. R., 155 N. Michigan Ave., Battle Creek, Mich.
Fennelly, M. J., Dist. Boiler Insp., N. Y. C. R. R., 30 Magnolia Ave., Jersey City, N. J.
Ford, Martin J., Boiler Insp., D. L. & W. R. R., 125 Tenth Ave., Scranton, Pa.
Gilbert, T., F. B. M., G. S. & F. R. R. Co., Macon, Ga.
Grosart, John, B. F., N. Y. C. R. R., 26 Bell St., Ashtabula, O.
Handlan, J. M., Asst. Foreman, O. W. R. R. & N. R. R., Albina Shop, Portland, Ore.
Hodges. Elmer S., Insp. Steam Boilers, Dept. of Public Works, 851 Eleventh St., S. E. Medicine Hat, Alberta, Can.
Holly, C. A., F. B. M., Erie R. R., 90 Francisco Ave., Rutherford, N. J.
Hughes, James W., B. F., Illinois Central R. R. Co., 1137 S. 15th St., Louisville, Ky.
Jacobs, Wm. C., Insp., Illinois Central R. R. Co., Palestine, Ill.
Johnson, N. S., Boiler Insp., N. Y. C. R. R. Co., Avis, Pa., Jersey Shore, Pa.
Kaiser, G. J., F. B. M., N. Y. C. R. R., 3720 Walton Ave., Cleveland, O.
Kernohan, John, F. B. M., Grand Trunk Ry., 412 West Main St., Ourand, Mich.
Kremer, John, F. B. M., Chicago, Mill. & St. Paul R. R., 4127 Lake St., Chicago, Ill.
Longmire, Samuel, B. Insp., Southern Pacific R. R., 824 Kentucky St., E. Bakersfield, Cal.

Luke, M. W., Gen. Boiler Foreman, B. & O. R. R. Co., Washington, Ind.
Maguire, Hugh W., F. B. M., Lehigh & New England R. R., Penn Argyle, Pa.
Mitchell, John, Boiler Maker, Q. & C. R. R., Somerset, Ky.
McCarthy, Frank F., Asst. Foreman, N. Y. C. R. R., 566 E. 118th St., Cleveland, O.
McGarrigal, John, B. F., Illinois Central R. R., 1304 Jackson St., Paducah, Ky.
McLean, William, B. F., A. T. & S. F. R. R., Belen, N. M.
Nelson, Jos J., B. Insp., Erie R. R., Box 164, Kent, O.
Newton, W. T., B. F., A. T. & S. F. Ry. Coast Lines, Seligman, Ariz.
Nicholas, E. S., B. M. F., Missouri Pacific Ry., 114 No. Jackson, Kansas City, Mo.
O'Connor, Boiler Insp., Boston & Albany R. R. Co., 45 Irving St., West Springfield, Mass.
Peck, L., B. F. Insp., Pittsburgh, Shawmut & Northern R. R., Angelica, N. Y.
Phares, John L., B. M. F., Western Maryland R. R., 11 First St., Elkins, W. Va.
Porter, E. C., B. M. F., C. & N. W. Ry. Co., 740 Camanch Ave., Clinton, Ia.
Prout, Geo. T., B. M. F., Chesapeake & Ohio Ry., 138 E. 19th St., Covington, Ky.
Quinlan, E. G., B. Insp., M. K. & T. Ry., 1921 Crawford St., Parsons, Kas.
Redmond, A. J., B. F., Long Island R. R., 95 Forest Ave., Rockville Center, L. I.
Sheets, George C., Boiler Insp., Philadelphia & Reading, 1504 Centre Ave., Reading, Pa.
Sprouse, W. J., B. M. F., Arizona Eastern R. R. Co., Globe, Ariz.
Stevens, Henry V., B. M. F., A. T. & S. F. Ry., 472 West 4th St., Emporia, Kan.
Sweeney, E. J., Asst. B. M. F., N. Y. Central R. R., 659 Okley Ave., Hammond, Ind.
Thurston, R. A., Asst. Gen. B. Insp., Missouri, Kansas & Texas Ry., 915 N. 12th St., Waco, Tex.
Usherwood, T. W., Dist. B. Insp., N. Y. C. R. R., 108 East Colvin St., Syracuse, N. Y.
Welk, John L., Gen. B. Insp., Wabash R. R., 959 E. Eldorado St., Decatur, Ill.
Whalen, Chas. P., F. B. M., N. Y. C. R. R., Seymour St., Syracuse, N. Y.
Wise, August, F. B. M., Chicago, Indianapolis & Louisville Ry., 1001 Roberts St., LaFayette, Md.

ASSOCIATE.

Alfonte, P. B., Welding Instructor, Oxweld Ry. Service Co., 3351 Indiana Ave., Chicago, Ill.
Cooper, Fred R., Sales Manager, Breakless Staybolt Co., Second National Bank Building, Chicago, Ill.
Fritchie, Franklin W., District Inspector, I. C. C., Post Office Building, Columbus, O.
Mahar, Thomas, Travelling Engineer, American Arch Co., 12 Spring St., White Plains, N. Y.

Seley, C. A., President, American Flexible Bolt Co., 1022 McCormick Building, Chicago, Ill.
Squire, Willis C., Western Sales Agt., Breakless Staybolt Co., 537 So. Dearborn St., Chicago, Ill.
Tracey, Bernard C., Supv. Electric Welding, B. & O. R. R., 2677 Wilkins Ave., Baltimore, Md.
Reid, Johnson Crayton, Boiler Expert, Oxweld Railroad Service Co., 339 Railway Exchange, Chicago, Ill.
Riddle, Carlton, Supt., The McNeil Boiler Co., Akron, O.

Constitution and By-Laws

As Amended 1908-1909-1911-1913-1915.

ARTICLE I.

NAME.

"Master Boiler Makers' Association."

ARTICLE II.

The object of this Association shall be the mutual improvement of its members by an exchange of ideas in meetings, the reading and discussion of papers, and a general interchange of views, so that all may profit by the experience of others more proficient in our craft.

ARTICLE III.

Section 1.—The officers of this Association shall consist of a President, First, Second, Third, Fourth and Fifth Vice-Presidents, who shall be active Master Boiler Makers, Assistant Foremen or General Boiler Inspectors and engaged as such at the time of election; a Secretary and a Treasurer.

Sec. 2.—The office of President, First, Second, Third, Fourth and Fifth Vice-Presidents, Secretary and Treasurer shall be elective at the annual convention.

Sec. 3.—The election of officers of the Association shall be by ballot. They shall be elected separately, and a majority of all votes cast shall be necessary for choice.

Sec. 4.—Only active members in good standing shall be allowed to ballot for officers.

ARTICLE IV.

EXECUTIVE BOARD.

Section 1.—There shall be an Executive Board, to consist of nine (9) members.

SEC. 2.—The Executive Board shall be elected by ballot, said Board to elect their chairman to serve during the time of his incumbency, each elected member to serve three years.

ARTICLE V.

DUTIES OF PRESIDENT.

It shall be the duty of the President to preside at all meetings of the Association; to appoint all committees; decide all points of order; receive and submit all motions duly made by the members; put to vote all motions regularly made, announcing the results, and voting only in case of a tie; and he shall exercise general supervision over the affairs of the Association.

ARTICLE VI.

DUTIES OF VICE-PRESIDENT.

The Vice-Presidents shall assist the President in such duties as he may require; and in the absence of the President shall preside at the meetings of the Association and perform all the duties of the office in their order.

ARTICLE VII.

DUTIES OF THE SECRETARY.

It shall be the duty of the Secretary to keep a correct record of all meetings of the Association, attend to correspondence, keep a record of the membership, receive all moneys and remit the same at stated intervals to the Treasurer, take charge of all books, papers and other property, and perform such other duties pertaining to his office as may be required of him by the Association.

ARTICLE VIII.

DUTIES OF THE TREASURER.

It shall be the duty of the Treasurer to receive and receipt for and safely deposit in a bank all moneys belonging to the Association; he shall keep a correct record of all moneys received, and submit to the President, Secretary and Chairman of the Executive Board, a quarterly statement of the condition of the treasury, showing the balance on hand at the previous report, the amount received and disbursed since the last report, together with the balance on hand; and shall pay out no moneys except on a voucher drawn by the Secretary and approved by the Chairman of the Executive Board.

ARTICLE IX

BOND OF OFFICERS.

The Secretary of this Association shall be bonded by a Security Company for the sum of $1,000. The Treasurer shall be bonded for the sum of $2,000. The expense thereof shall be borne by this Association. The Executive Board shall be the custodian of the bonds.

ARTICLE X.

DUTIES OF THE EXECUTIVE BOARD.

SECTION 1.—The Executive Board shall exercise a general supervision over the interests of the Association; to call, to prepare for and to conduct annual conventions; to make all necessary purchases, expenditures and contracts required; to conduct the current business of the Association.

They shall have no power to make the Association liable for any debts to an amount beyond that which at the time of contracting the same shall be in the Treasurer's hands in cash and not subject to prior liabilities; all expenditures shall only be made by appropriations acted upon by the Executive Board.

SEC. 2.—The Executive Board shall make a report of the proceedings of each of its meetings, such report to be made accessible to all members of the Association. It shall have the proceedings of the regular meetings of the Association published, subject to the instructions from the latter. It shall have the power to withhold from the published proceedings, papers and reports containing old matter readily found elsewhere, those especially meant to advocate personal interests, those carelessly prepared or controverting well-established facts, and those purely speculative or foreign to the purpose of the Association, or any which in the opinion of the Board are unworthy of publication.

SEC. 3.—Two-thirds of the members of the Executive Board may call special meetings of the Association, to be held not less than thirty days after notice thereof has been mailed to each member of the Association.

SEC. 4.—The Executive Board shall have power to change the place of meetings if deemed necessary for the best interests of the Association.

ARTICLE XI.

MEMBERSHIP.

SECTION 1.—*Active Members* shall consist of Master Boiler Makers, Assistant Foremen and General Boiler Inspectors who are practical boiler makers, and filling such position at time of application.

Any subsequent change in their occupation or position, unless entirely foreign to the trade of boiler making, shall not affect their status in the Association, and they shall remain active members thereof during the time that they retain their membership and conform to all the rules and regulations of the organization.

Applicants for active membership shall submit their request in writing, give name in full and name and address of the road or company by which they are employed.

Applications for active membership must bear the signatures of at least two members of the Association in good standing.

SEC. 2.—*Associate Members* shall consist of men who have served as Master Boiler Makers, or others whose experience shall be valuable to the Association. Such members shall not have the privilege of voting.

SEC. 3.—*Honorary Members* shall consist of those who have served as active members and on account of old age or ill health have been obliged to retire from active service; such members shall not be required to pay dues.

SEC. 4.—Applications for membership may be approved by the Chairman of the Executive Board during "recess" periods of the Association but must be finally ratified at the next annual convention by the Association.

ARTICLE XII.

FEES AND DUES.

SECTION 1.—The initiation fee in this Association shall be Three Dollars ($3).

SEC. 2.—The Annual dues shall be Two Dollars ($2) per year, payable in advance on April 1st of each year.

SEC. 3.—The initiation fee of $3 shall accompany each application for membership. Dues payable as per SEC. 2 of this Article.

ARTICLE XIII.

MEMBERS IN ARREARS.

Members in arrears for dues may occupy seats in the convention, but they shall not be entitled to vote or take part in any discussion, nor in the transaction of any business brought before the convention, until such arrears are paid; and after the expiration of one (1) year the Secretary shall notify such members that they will be suspended for non-payment of dues unless their arrearage is paid within thirty (30) days after such

notice has been given. Members shall not be entitled to receive a copy of the published proceedings of conventions unless their dues have been paid as required by the Constitution and By-Laws.

ARTICLE XIV.

Any member of this Association may at any time withdraw from this Association by making application for a withdrawal card which will be granted provided his dues are paid for the year in which application is made and which can be deposited at any time thereafter he desires by paying one ($1.00) dollar, the application being subject to Section 4 of Article XI. of this Constitution.

ARTICLE XV.

MEETINGS.

SECTION 1.—The place for each annual meeting shall be fixed at least six months before the annual meeting by the Executive Board, to which all invitations therefor shall be sent by the Secretary to the Chairman of the Board. The Board shall also at the same time decide upon the days and hour of assembly, and when determined shall at once notify the Secretary of the same and the Secretary shall mail to each member not later than 60 days in advance of such annual meeting, notice of the place, date and hotel rates, with such other information concerning the arrangements as may be in his possession. Immediately after the place and time have been fixed the President shall appoint a local committee to make all necessary arrangements for the convention, and they shall have charge of the same. The convention shall continue four (4) days, with daily session from 9 A. M. to 1 P. M., these hours, however, to be subject to change as circumstances may make necessary, and the convention may determine by a majority vote of the members present.

ARTICLE XVI.

COMMITTEE REPORTS FOR ANNUAL CONVENTIONS.

SECTION 1.—The reports of all standing and special committees must be in the office of the Secretary not later than March 1st in order that the same can be printed and advance copies issued by April 1.

Such reports shall be prepared for printing and presentation to the convention by the Chairman of each Standing or Special Committee to whom each member of a Committee shall send, not later than January 1st, his individual report, such individual report to be read before the convention if desired or called for, but only the report printed shall be included in the published Proceedings of the convention, unless such individual report, or a minority report of the Committee, shall be adopted by a majority of the convention in place of the majority report of the Committee.

Each Chairman of a Committee shall promptly submit the report prepared by him to his associates on his Committee and obtain their concurrence, amendment or rejection, a majority of the members concurring to govern in the final adoption of the report for presentation to the Convention.

Committee reports which do not reach the Secretary in time for printing and issuing by April 1st, will be referred to the Executive Board to decide whether the report shall be submitted to the Convention.

The Chairman of Standing and Special Committees will read an abstract of the report of the Committee before the Convention, together with whatever additional data may have been accumulated after April 1st, to the date of the Convention.

The members of Standing or Special Committees, who may individually or collectively submit a minority report, must prepare the same so that it can be issued with the report of the majority of the Committee, to substitute for the majority report in the event the Convention should so decide.

Each member of a Standing or Special Committee shall sign either the majority or a minority report.

SEC. 2.—*Quorum.* Nine members at any meeting shall constitute a quorum for the transaction of business, but any less number shall have power to adjourn to any time and place they may deem proper.

ARTICLE XVII.

AMENDMENTS.

No article or clause to the foregoing Constitution shall be altered, amended or repealed except at an annual meeting and then only by a two-third (2-3) vote of the members present.

ARTICLE XVIII.

ORDER OF BUSINESS.

1. Roll-call.
2. Report of Officers.
3. Report of Committees.
4. Unfinished Business.
5. New Business.
6. Election of Officers.
7. Appointment of Committees.
8. Adjournment.

Membership List

HONORARY MEMBERS.

Duntley, J. W., Duntley Co., Church St., New York City.
Duntley, W. O., Pres., Chicago Pneu. Tool Co., 1010 Fisher Bldg., Chicago, Ill.
McManamy, Frank, Chief Insp. Loco Boiler Dept., I. C. C., Washington, D. C.
Lape, Charles F., Scully Steel & Iron Co., 104 Stimson Block, Los Angeles, Cal.
Pratt, E. W., Supt., S. M. P., C. & N. W. R. R., Chicago, Ill.

ACTIVE MEMBERS.

Addis, Robert, F. B. M., Texas & Pacific Ry., Fort Worth, Tex.
Ainslie, P. C., F. B. M., Canadian Pacific Ry., Moose Jaw, Box 9, Sask., Can.
Akins, A. A., F. B. M., C. G. W. R. R., 24 Second Ave., North, Oelwein, Ia.
Albrecht, J. A., F. B. M., N. Y. Central R. R. Co., 14 Paul Place, Buffalo, N. Y.
Aldcorn, William, F. B. M., N. Y., O. & W. R. R., 32 Griffin St., Norwich, N. Y.
Alfonte, P. B., Welding Instructor, Oxweld Ry. Service Co., 3251 Indiana Ave., Chicago, Ill.
Allison, Archie, F. B. M., Denver & Rio Grande R. R., Box 367, Helper, Utah.
Anderson, Andrew, Box 227, De Quincy, La.
Ardis, L. C., Foreman, Boiler Dept., P. B. & W. R. R., 225 W. 30th St., Wilmington, Del.
Armshaw, Herbert, F. B. M., Canadian Pacific Ry., 640 Home St., Winnipeg, Man., Can.
Ashback, Joseph O., 1110 Palmer St., Miles City, Mont.
Ashcroft, Joseph W., F. B. M., C. P. R. R., 1518 Ross Ave., Winnipeg, Man., Can.
Atkinson, William B., F. B. M., M. & N. A. R. R., Box 107, Harrison, Ark.
Austin, George, G. B. I., A. T. & S. F. R. R., 23 Devon Flats, Topeka, Kans.
Baird, A. M., Asst. Supt. Shops, A. T. & S. F. R. R., 1318 W. 10th St., Topeka, Kans.
Barclay, Elmer J., F. B. M., G. & F. R. R., Douglas, Ga.
Batchman, F. A., F. B. M., N. Y. Central R. R. Co., 1421 Krau St., Elkhart, Ind.
Baty, C. E., B. M. F., I. & G. N. R. R., 910 Beuna Vista St., Sta. A., San Antonio, Tex.
Baumann, C. J., F. B. M., N. Y. N. H. & H. R. R., 305 Howard Ave., New Haven, Conn

Bader, Cornelius, F. B. M., N. Y. C. & H. R. R. R., 651 Calvary Ave, Detroit, Mich.
Bayer, Fred, B. M. F., P. C. C. & St. L. Ry., 41 C St. Clair Ave., Columbus, O.
Beck, John F., F. B. M., G. R. & I. R. R., 426 Thomas St., Grand Rapids, Mich.
Beland, Arthur J., F. B. M., Chicago Junction, 7346 Kenwood Ave., Chicago, Ill.
Bennett, C. R., B. M. F., Penn. R. R., Logansport, Ind.
Bennett, G., Foreman, Boiler Shop, Penn. R. R., P. O. Box 238, Perona, Pa.
Bennett, G. W., Dist. Insp., I. C. C., 15 Kent St., Albany, N. Y.
Berrey, Frank E., F. B. M., Erie R. R., 5315 Julia Ave., Cleveland, O.
Berry, John, Boiler Insp., Grand Trunk R. R., 172 Fern Ave., Toronto, Ont., Can.
Billington, Matthew, F. B. M., B. R. & P. R. R., 17 Cross St., E. Salamanca, N. Y.
Boaman, John P., Asst. B. M. F., Philadelphia & Reading Ry. Co., 425 Spruce St., Reading, Pa.
Bock, L. C., F. B. M., I. C. R. R., Fort Dodge, Ia.
Bolman, H. E., Asst. Foreman B. M., C. & O. & I. Ry., 481 W. Main St., Peru, Ind.
Bowen, L. P., Travelling Eng., Bird Archer Co., 90 West St., New York City.
Bowes, C. H., Insp., N. Y. Central R. R. Co., 116 Glover St., Jersey Shore, Pa.
Borneman, L., F. B. M., C. St. P. M. & O. R. R., 1121 Sleby Ave., St. Paul, Minn.
Bower, William G., F. B. M., Chicago & N. W. R. R., 4157 Washington Blvd., Chicago, Ill.
Brandt, John A., Gen. Boiler Insp., N. Y. O. & W. R. R., 343 North St., Middletown, N. Y.
Bresette, R. B., B. M. F., C. & N. W. R. R., 1012 S. 4th St., Clinton, Ia.
Brown, A. E., G. F. B. M., L. & N. R. R., Shops, 112 E. 16th St., New Albany, Ind.
Browning, C., F. B. M., Grand Trunk R. R., 53 Cherry St., Battle Creek, Mich.
Bryant, G., F. B. M., C. N. O. & T. P. R. R., 101 Park Ave., Ludlow, Ky.
Bunting, J. S., Boiler Insp., Southern Pacific Co., 1515 Beale St., E. Bakersfield, Cal.
Burnside, C. J., G. F. B. M., N. Y. C. & St. L. R. R., 424½ Harbor St., Conneaut, O.
Burton, E. L., F. B. M., A. T. & S. F. Ry., 2011 Orange St., Bakersfield, Cal.
Butler, Maurice, 806 Madison Ave., S. E., Grand Rapids, Mich.
Campbell, Jesse C., B. F., Missouri, Kansas & Texas Ry. Co., 622 W. Owing St., Denison, Tex.
Cannon, W. J., Chief Boiler Insp., Pere Marquette R. R., Box 140, Detroit, Mich.
Cantwell, Edward, B. F., Big Four, Bellefontaine, O.
Carder, J. F., F. B. M., St. L. S. F. & T. R. R. (Frisco), 1016 E. Williams St., Sherman, Tex.
Carder, L. J., F. B. M., Kans. City Southern R. R., 1702 Grand Ave., Pittsburg, Kans.
Carroll, S. M., B. M. F., C. & O. R. R., 1840 Third Ave., Huntington, W. Va.

Casey, R. M., Foreman, Boiler Shop, C. & O. R. R., Clifton Forge, Va.
Charlton, Wm. F., G. B. I., S. P. L. A. & S. L. R. R., Box 138, Las Vegas, Nev.
Chastain, J. H., B. M. F., N. C. & St. L. R. R., 299 S. Boulevard, Atlanta, Ga.
Chincholl, Carl A., Layerout, C. R. I. & P. R. R., Box 55, Chickasha, Okla.
Clark, Chas. J., Sr., F. B. M., Penn. R. R., 1226 N. 50th St., Philadelphia, Pa.
Clark, James C., Gen. Foreman, P. & R. Ry., 909 N. Third St., Reading, Pa.
Clark, R. W., F. B. M., N. C. & St. L. R. R., 1613 Jo. Johnson Ave., Nashville, Tenn.
Clay, A. E., Loco. Boiler Insp., A. T. A. S. F. R. R., Needles, Cal.
Conley, Albert H., F. B. M., Penn. R. R., 208 N. 4th St., Olean, N. Y.
Conner, F. M., G. F. B. M., C. N. O. & T. P. R. R., Box 14, Somerset, Ky.
Conrath, P. J., Boiler Tube Expert, National Tube Co., 4414 Michigan Ave., Chicago, Ill.
Cook, A. A., B. M. F., O. W. R. R. & N. Co., La Grande, Ore.
Cooke, E. J., F. B. M., B. & O. R. R., 1240 Palto St., Pittsburgh, Pa.
Cook, J. E., M. B. M., Bessmer & Lake Erie R. R., Greenville, Pa.
Cook, Walter, F. B. M., Grand Trunk Pacific R. R., 111 Clark St., Winnipeg, Man.
Cook, Wm., Boiler Insp., Chicago Shops, Chicago Rock Island & Pacific Ry. Co., 6930 Michigan Ave., Chicago, Ill.
Cook, Wm., B. M. F., Pacific Coast Ry. Co., 611 Bright St., Seattle, Wash.
Cooper, Alfred, G. F. B. M., St. Jos. & G. I. R. R., 2223½ Felix St., St. Joseph, Mo.
Cooper, Fred R., Sales Manager, Breakless Staybolt Co., Second National Bank Bldg., Chicago, Ill.
Cooper, J. H., G. B. I., Ann Arbor R. R., Owosso, Mich.
Cosgrove, P. E., G. F. B. M., Elgin, Joliet & Eastern R. R., Joliet, Ill.
Courtney, M. S., G. B. I., Great Northern R. R., St. Paul, Minn.
Creger, R. A., B. M. F., N. P. R. R., 415 9th St., S. Brainerd, Minn.
Crimmins, R. P., F. B. M., Big Four R. R., Mattoon, Ill.
Crites, John O., G. B. I., Penn. R. R., 928 High St., Williamsport, Pa.
Crombie, James, F. B. M., Samuel Smith & Son Co., Paterson, N. J.
Cross, L. E., F. B. M., N. Y. Central R. R. Co., 4612 Westropp Ave., Cleveland, O.
Cunningham, Alex., B. M. F., Missouri, Oklahoma & Gulf Ry., 539 S. 6th St., Muskogee, Okla.
Cusick, W. A., M. B. M., Central Loco. Wks., Chicago Heights, Ill.
Dacey, M. J., F. B. M., 1296 South York St., Denver, Colo .
Daley, Frank, F. B. M., Lidgerwood Mfg. Co., 50 Wolcott St., Brooklyn, N. Y.
Daly, James, Boiler Insp., Chicago Indian So. R. R., 479 E. State St., Hammond, Ind.
Daly, John J., F. B. M., P. & R. Ry., 1159 N. 5th St., Reading, Pa.
Davey, J. J., G. B. I., Northern Pacific Ry., N. P. Cen. Office Bldg., St. Paul, Minn.
Dean, C. C., Gen. Boiler Foreman, Wabash R. R., Decatur, Ill.
Deen, W. H., F. B. M., C. & O. OF I. R. R., 466 W. Main St., Peru, Ind.
Denzler, H., F. B. M., Penn. R. R. Shops, Indianapolis, Ind.

Dickman, A. H., Boiler Insp., Atlantic Coast Line, 609 Day St., Florence, S. C.
Dickman, H. J., B. M. F., Atlantic Coast Line, 609 Day St., Florence, S. C.
Didier, J. L., F. B. M., Southern Ry., Salisbury, N. C.
Dittrich, A. C., Gen. Boiler Insp., Soo Line, 1409 N. 5th St., Minneapolis, Minn.
Doarnberger, J. A., M. B. M., N. & W. R. R., Roanoke, Va.
Dobson, F. R., Boiler Foreman, A. T. & S. F. R. R., Calwa City, Cal.
Doolin, Richard, Night Boiler Maker Foreman, Eng. House, N. Y. Central R. R. Co., 704 Sohl St., Hammond, Ind.
Dougherty, George E., Dist. Insp. Loco Boilers, I. C. C., 312 Post Office Bldg., Shreveport, La.
Downs, James L., F. B. M., N. Y. Central R. R. Co., 1017 Nelson Ave., High Bridge, N. Y.
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